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ABSTRACT

GRADES OR AGES: Grades 7-12. SUBJECT MATTER: Industrial arts. ORGANIZATION AND PHYSICAL APPEARANCE: The introductory material describes the purpose of the guide, defines industrial arts, lists the major objectives, gives safety rules, and discusses instructional aids. A section of the guide is devoted to each of the subjects covered in the course--dratting, electricity and electronics, graphic arts, industrial crafts, metals, power mechanics, and woodwork. The guide is lithographed and spiral bound with a hard cover. OBJECTIVES AND ACTIVITIES: The objectives are listed at the beginning of each section. Only outlines of units are given with no detailed descriptions of activities. INSTRUCTIONAL MATERIALS: General information on instructional materials is given at the beginning of the guide. Additional information on charts, pamphlets, films, filmstrips, transparencies, books, and magazines is given at the end of each section. STUDENT ASSESSMENT: No provision is made for student evaluation. (MBM)

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INDUSTRIAL ARTS EDUCATION

*METALS
*DRAFTING
*WOODWORK
*GRAPHIC ARTS
*ELECTRONICS
*POWER MECH.
*IND. CRAFTS

CURRICULUM GUIDE FOR SOUTH DAKOTA

SP007282

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FOREWORD

Industrial Arts has been a part of the high school curriculum for many years and most of the larger school systems have had one or more courses. However, there has been no general agreement as to what constitutes an adequate industrial arts program. This curriculum guide was prepared to help identify the courses which should be a part of any good program.

The purpose of this guide is to help school administrators and industrial arts teachers plan a modern curriculum based upon the latest developments in the field. School district reorganization is gaining momentum in our state, and with the creation of larger attendance centers, comes the need for a more comprehensive secondary school program. In any expansion of the curriculum, industrial arts should receive a great deal of emphasis.

Since industrial arts is not a vocational education program its purpose is not to prepare a person with a saleable skill. It is an introductory and exploratory program and should be introduced in junior high and continued through the senior high school. Taught as an exploratory course it gives students the opportunity to identify their areas of greatest interest before they make the decision which commits them to a definite vocational or technical course.

The State Board of Education and the Department of Public Instruction recognize the importance of industrial arts as a part of the school curriculum and urge school boards and school administrators to give careful consideration to incorporating a complete course in their school program. This guide was not developed to produce identical programs in all schools but to help those responsible for curriculum planning to develop a modern program of industrial arts and assist them in implementing the program which best meets the needs of their particular community.

On behalf of the State Board and the Department of Public Instruction we take this means of publicly expressing our appreciation to the members of the committee who worked so long and diligently to develop this guide. We extend thanks to them for performing this service and for showing so much concern for this long neglected part of the school curriculum. This guide has been designed to be used in schools of all sizes and we recommend its use to all school administrators and industrial arts teachers. If this handbook helps to improve industrial arts instruction in our schools, the efforts of the persons preparing it will not have been in vain and the youth of our schools will be the ones who benefit from it.

F. R. Wanek
Acting State Superintendent
March, 1967

PREFACE

Twenty-six[1] years have lapsed since the last publication of an industrial arts bulletin dealing with curriculum material or a guide for instruction. Earlier a more detailed bulletin[2] was issued with the combination approach, Industrial Arts and Trades.

The steering committee began its work with a resolution from the South Dakota Industrial Education Association in its first fall meeting at Chamberlain, November 21, 1964. The original committees appointed have been revised during the last three years; the final publication committees are listed in identification.

Industrial arts education is a well established and vitally important curriculum area. The committee is well aware of an increasingly growing gap between industrial reality and its representation in the total educational program. In this publication the traditional approach to industrial arts education is used. New curriculum design can be incorporated into subsequent revisions.

Distribution of this guide will be primarily through the local school systems having industrial arts and those anticipating the organization of new programs. The former will be achieved through the assistance of current industrial arts instructors; the latter through the cooperation with the South Dakota Board of Education.

Assistance and cooperation is also anticipated from the South Dakota Association of Secondary Principals, the South Dakota Education Association, and departments or divisions of industrial arts in South Dakota colleges.

A general improvement in the quality of instruction in industrial arts will depend upon the extent to which this guide can be utilized and studied by the instructor and the school. Existing South Dakota programs must be improved. Newly installed programs from the beginning must be dynamic and adequate.

This state-level publication is an in-service media to improve instruction and safety for industrial arts education in South Dakota. Use this guide now. Plan immediately for a new improved guide.

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[1] An Introductory General Shop Course for Small High Schools, 1941, pp. 29.

[2] Industrial Arts and Trades for Secondary Schools, 1935, pp. 192.

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SOUTH DAKOTA

INDUSTRIAL ARTS EDUCATION CURRICULUM GUIDE

GRADES VII-XII

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1967

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INTRODUCTION

In behalf of the State Board of Education, the Division of Vocational-Technical Education would like to express appreciation to all active participants who have given of their time in the preparation of this Curriculum Guide for further development of Industrial Arts Education in the State of South Dakota.

The benefit of this Guide will be only as effective as the use to which the administrators and instructional staffs of our public schools fully utilize it in development of their programs across the state.

As the State Director of Vocational Education, I would encourage the full utilization of this Guide in the development of the total education program to meet the needs of our young people today. With Industrial Arts Education as an integral part of the total education program in our schools, much can certainly be done in preparing youngsters with the necessary information to choose their life-time vocation whether it is professional, semi-professional, trade, technical or service occupation.

E. B. Oleson
State Director

INDUSTRIAL ARTS CURRICULUM GUIDE FOR SOUTH DAKOTA - GRADES 7-12

Purpose of This Guide

The purpose of the guide for industrial arts for the State of South Dakota is to help each teacher do an effective job of instruction from the seventh grade through the twelfth grade. It is designed to be helpful to the small schools as well as the larger schools in the state.

The high school with a total enrollment of 90 students should plan for industrial arts work to be taught by a fully qualified teacher. Industrial arts work for the small school may start with drafting classes and/or the general shop. Drafting in this area is interpreted to be basic mechanical drawing. General shop for the small school may be interpreted to be principally woodworking with the addition of the introductory units such as sheet metal, power mechanics, bench metal, foundry, welding, depending upon the qualifications of the instructor and the interests of the community.

A high school with a total enrollment of approximately 200 should think in terms of employing one full-time instructor in the field of industrial arts. Industrial arts programs, such as drafting, should include mechanical drawing and samplings of machine drawing, sheet metal drawing, architectural drawing, schematics for welding, and schematics for electricity and electronics. The general shop should have balanced equipment and effective instruction in woodworking, metal working, industrial crafts, and/or all areas covered.

The school with an enrollment of 300 students should be alerted to call up specialized help for the stronger curriculum patterns in the industrial arts field.

It is the intent of this publication to serve as a guideline for industrial arts teaching in South Dakota. It has been laid out by experienced industrial arts teachers as a reasonable guideline to follow with realistic goals and standards. The individual teacher may vary its use to make it workable with the materials at hand, the space available and the equipment issued for industrial arts.

This guide will also be of help to the administrator who is not familiar with the industrial arts program. The guide is intended to help him understand more about the subject, to be able to select qualified teachers and to provide adequate classroom, tools, machines, equipment and materials. If the supervisor at any time has trouble interpreting the guide, his first source of help should be his industrial arts teacher. The guide is intended to help improve the teaching of industrial arts throughout the State of South Dakota.

DEFINITION OF INDUSTRIAL ARTS

Industrial arts is concerned with the orientation of the individual to the technical-industrial side of society which would enable him to deal with consumer goods production, leisure time activities and to act intelligently in regard to health and safety as affected by industry.

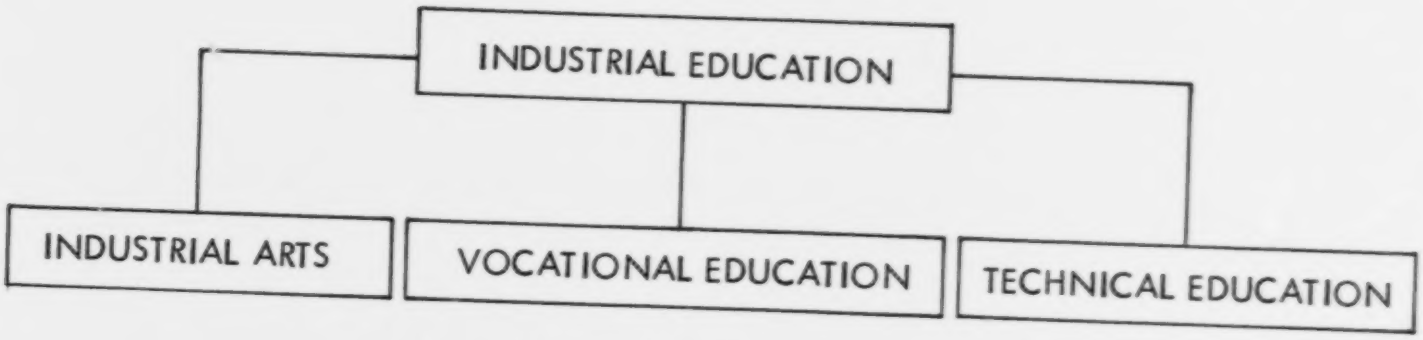
Industrial arts is a phase of general education that deals with materials, process, products of manufacture and with the contribution of manufactured products as used in society. The knowledge and skills come from and through the pupil's experience with tools and materials and through his study of the industrial processes as found in his technical society.

Industrial arts is a curriculum area rather than a subject field offering the individual an insight into our industrial society through classroom experience with tools, materials and equipment. It provides a means by which the student can apply in practical and meaningful situations the theoretical principles of science, mathematics, social studies and other related subjects.

PHILOSOPHY OF INDUSTRIAL ARTS

Education should be aimed at the needs of the student. It must first look at all of the environment to determine the pattern required of a responsible citizen. Education must help the student to adjust to the environment in which he lives to provide him with the information and knowledge to adjust to economics of the times in a socially accepted manner. Education should be flexible enough to provide experiences for all students regardless of age, sex, race, religion, social or economic standing. The individual is the core of our society. Education must equip him to live successfully within it. Industrial arts is an important part of general education because it helps to satisfy these requirements.

Industrial arts plays a unique role in the education of youth. It develops the student's ability to explain his own ideas and interpret the ideas of others. It develops his ability to design and appreciate useful articles and to plan orderly procedures in making them. It offers practical exploration experiences. Industrial arts develops in the student the ability to make good use of his leisure time through crafts and hobbies. It provides practical applications of theoretical conditions. Industrial arts education reflects, better than any other subject, the changes of industrial technology and its impact on culture. It is an important "conditioner" for life.



A COMPARISON OF INDUSTRIAL ARTS, VOCATIONAL EDUCATION, AND TECHNICAL EDUCATION

	INDUSTRIAL ARTS	VOCATIONAL EDUCATION	TECHNICAL EDUCATION
Type of Training	General exploratory education of industrial processes	Specialized training in a trade skill	Extensive knowledge of a field of specialization
Grade Levels	Grades 1 - 12	Grades 9 - 12	Post-high school or junior college
Hours per Week	1 - 10 hours per week	Minimum of 15 hours per week	Unspecified
Time and Location	Classes during regular school day on school grounds	During school day, school may or may not be on high school grounds	Classes day and night, on post-high school campus
Curriculum	Introduction to American industry through courses in woods, metals, textiles, photography, electricity and others	Subjects vary with needs of community	Mathematics, sciences and engineering processes as related to the field
Teacher Preparation	College Graduate	Skilled tradesman need not be a college graduate	College graduate (minimum)
Job Placement	No effort for job placement	Students placed and followed	Students placed and followed, or may be oriented toward higher education
Equipment Necessary	Hand tools; small, less expensive equipment	Modern production equipment essential	Modern production equipment essential
Federal Aid		Federal aid	Federal aid

OBJECTIVES FOR INDUSTRIAL ARTS*

1. To develop in each student an insight and understanding of industry and its place in our culture.
2. To discover and develop talents of students in the technical fields and applied sciences.
3. To develop technical problem-solving skills related to materials and processes.
4. To develop in each student a measure of skill in the use of the common tools and machines.

* "Improving Industrial Arts Teaching" - Conference Report - 1960

GENERAL SAFETY FOR INDUSTRIAL ARTS

The growing importance of safety as an instructional obligation of the public schools is rapidly becoming a matter of general public interest. Industrial arts education is fully aware of the importance of safety administration. Because of the close relationship to the work of industry and the obvious safety hazards presented by the constant use of machines and tools by immature boys and girls, it is of particular urgency that the instructor and administrator be constantly concerned with and always alert to the prevention of accidents in the shop. The industrial arts teacher must consciously undertake the formulation of a definite safety program that he can carry out in his shop, and which will carry over into the students' lives in school as well as in the home. Excellent general safety conditions must always exist in the laboratory. Detailed and specific safety must be taught in the area as instruction progresses stage by stage.

The instructor must face squarely the premise that in certain accidents and situations he can be held legally liable. With our everyday life becoming more complex and our shops being furnished with more machines and equipment, an increased emphasis and demand for organized safety instruction is imperative.

An effective school safety program does not just happen, it is the result of careful and continual planning.

The responsibility for a safety program in industrial arts concerns the administration, the teacher and the pupil.

The responsibility of the administrator and teacher is fourfold: (1) to plan in detail all needed safety regulations; (2) to provide all necessary facilities for administering the regulations; (3) to secure the complete cooperation of industrial arts teachers in the execution

of the regulations; and (4) to make frequent inspections of shops and maintain persistent supervision of shop practices.

It is the responsibility of the teacher to carry out the safety instructions. He must emphasize the practical application of safety in the school, home and industry. It is up to him to keep the machines, equipment and tools in good condition at all times.

The pupil should be made continually safety conscious and he should participate in all forms of safety instruction. He should appreciate the need for and use of all devices and practices.

Teachers of industrial arts should be familiar with the laws of the state covering legal ordinances that may affect his work. By providing insurance, getting permission from the parents, having a first aid kit and having a knowledge of first aid, the teacher may be safeguarded. The teacher may be further safeguarded by giving adequate instruction in machine safety, giving personal permission at the time of operation of machines and by testing on the principles of their operation.

Positive safety education is based on accident prevention. It should be a part of every course of study and industrial arts teachers should teach, practice and display safety as a part of their planned and organized instruction. Because of legal liability and moral responsibility, it is necessary for every industrial arts teacher to prevent accidents by eliminating, as far as he can, all mechanical and physical hazards. Positive safety instruction is self-preservation for the pupil, for the teacher and for the administrator.

The school shop safety program has the following objectives: (l) prevention of accidents; (2) provision for first aid; (3) making the student safety conscious.

The teacher should get into the habit of checking the set up of machines before permission is granted to start the machine. Demonstrations, films, bulletin boards and charts are good ways of impressing safety upon the students. Tests should be given after safety points have been stressed and studied. The teacher should practice constant supervision, know the hazards of overtime and off schedule work by the students and continually check unreliable students. Safety zones should be marked around power machinery and all hand and power tools with cutting edges should be kept sharp.

Certain danger points which seem to be common in all shops are: power driven machines, cutting edges, electrical devices, volatile fluids, molten and heated metal and all heating and melting equipment, all projecting objects, slippery floors, insufficient and/or misplaced or glaring lights. In addition other less obvious factors are: room temperature, washroom and drinking water facilities, clothing, stairways, proper ventilation, finishing rooms and storage racks, lack of instruction in proper handling of tools and materials, conduct and avoidance of muscular or nerve fatigue.

Most accidents can be attributed to one of the following causes: (1) conditions of room and equipment, (2) inefficient instruction, (3) personal effects and (4) personal behavior.

Every shop should have a cabinet of first aid materials. Regardless of how trivial the accident, first aid should be applied and the accident reported.

INSTRUCTIONAL AIDS

It is expected that every instructor will have a supply of adequate texts and the necessary equipment to conduct a class. These are not always enough, however, to teach interestingly or effectively. Especially is this true in the field of industrial arts. In industrial arts doing is the prime means of learning, so activities outside the classroom as well as within the classroom are necessary. The alert industrial arts teacher makes use of all the activities and instructional aids that he can.

The teaching aids an instructor uses can make the difference between a dull class and an interesting one. They may make the difference between an inspired student and a drop-out. Instructional aids are far too important a part of a teacher's presentation to be slighted. Sometimes a teacher feels that the added time and effort used to prepare a specific aid is more than the value received. This may seem particularly true in view of the fact that instructional aids sometimes seem hard to find. This may be because the teacher often looks for something spectacular. This need not be so.

There are many aids that a teacher can develop on his own or with the help of other industrial arts areas. For instance, large-size models of T-squares, dividers, triangles and protractors can be made in the woodshop and used in the drafting room. In turn the drafting classes can make large drawings for visual aids in other areas. The machine shop can make screw threads and machine parts for demonstrations and display, while the woodshop can make patterns for the machine shop.

A good live bulletin board that can be, and is, changed regularly is one of the best visual aids. Pictures, drawings, and models from past classes, magazine advertisements and articles, illustrations from printed sources, catalogs, diagrams, charts and graphs are among the many things that can be displayed. True, the instructor will have to be constantly on the lookout, but he will find the interest shown by the student highly rewarding. A committee of students can be of infinite help in locating and selecting suitable material and student participation can generate an interest to be gained in no other way.

Local machine shops, garages, appliance shops, radio and TV shops, furniture stores, lumber yards, contractors, electrical shops, plumbing shops, sheet metal shops all have illustrations, diagrams, charts, plans and posters of their products which they are happy to loan or give outright to schools. Not infrequently these concerns have sample products they will loan or give, also. Displays can be made of these and sometimes actual drawings or models can be made from them. Collecting these need not be a difficult thing. Here again a student committee can be of great help.

No source is too small or too large. Sometimes the most unlikely place can yield the most valuable material.

Your own class, school, and community are the areas to be investigated first. These places are most readily available and the products are usually free or are relatively inexpensive. They present activities that involve the students and they are interesting because of their familiarity.

Many schools maintain a materials resource center in which teaching, audio-visual aids, and books are filed and checked out to teachers. Some schools have a trained audio-visual person who can be of invaluable assistance to someone searching for ways to present materials. It is surprising, too, how one trained teacher can help another, even across seemingly unrelated fields, if that teacher will make his wants known.

While the teacher will find a wealth of instructional aids literally at his doorstep, his search should not stop there. The industrial arts instructor can readily build up his own file of teaching aids through inexpensive and/or free materials supplied through industry. Many companies are happy to comply with a teacher's request either by letter or postcard. A partial list of sources is found at the end of each area. The teacher is urged to make use of this list and add to it.

In addition to building a file of instructional material each teacher will, of course, develop his own presentation and activities. Presented here is a brief list of suggested activities which may be used as a guide to a teacher's thinking. No attempt has been made to identify these ideas with specific subjects. It is quite possible to use some of them in many different areas. By a few simple changes most can be adapted to any areas.

LEARNING ACTIVITIES AND TEACHING SITUATIONS

1. Show how people instinctively use drawings to express ideas -- cave drawings, Indian pictographs, children's early drawings of Mom and Dad and the house.
2. Through sketches, drawings and illustrations, show how an idea can be developed. Show how the graphic alone can present an idea and how it helps to clarify written work.
3. To show opportunities in industrial arts you may:
   a. Have guidance department make presentation.
   b. Have knowledgeable parent talk of opportunities.
   c. Have student research reports on opportunities.
   d. Post lists and discuss opportunities.
   e. Visit closest employment office.
   f. Have closest employment officer give report.
   g. Study specific industries.
   h. Visit local firm employing industrial arts students or graduates.
4. To introduce equipment have students make and display large size models or working drawings.

5. Demonstrate and discuss industrial arts techniques by using the overhead projector. Here models may also be used. The overhead projector is a valuable aid but don't let it take the place of the chalkboard.
6. Demonstrate each step in the development of an idea or a process. Use chalkboard or overhead projector.
7. Have students sketch objects of their own choosing, then draw them in working drawings. These objects can then be made in some other shop.
8. Show relationship of geometric figures to everyday objects. Have students make a list of objects using triangles, rectangles, other polygonal figures, circles, curves, ellipses, other geometrical figures and combinations. Have class draw representative objects and display.
9. Make models of geometric figures out of paper, wood, plastic, metal. (Christmas tree ornaments, for example.)
10. Purchase or construct a glass or transparent orthographic projection box.
11. Demonstrate time-saving devices such as templates and lettering guides.
12. Correlate industrial arts with other subjects:
    a. Math - through graphs, charts, geometric figures, diagrams.
    b. Geography - through maps, diagrams, contours.
    c. Art - through sketching, perspective, designs, commercial art, models.
    d. Home Economics - through room design, furniture design, house plans.
    e. History - through pictographs, maps, charts, designs, models.
13. Offer to make drawings, maps, models and graphs for other classes.
14. Make use of other classes: For instance, when the student is studying history, have him investigate the architecture, furniture, machines and industry of the period.
15. Show differences between past and present in manufacturing, industry and livelihood.
16. Exchange classes with other industrial arts areas.
17. Visit a working machine shop, cabinet shop, lumber yard, repair shop, electronics shop. Make use of every part of "Down Town".
18. Have local man in applicable trade speak to class.
19. Develop project sheets for each project complete with specifications.
20. Illustrate basics of good design in projects.
21. Develop and/or obtain student study guides.
22. Develop a library of representative and significant projects.
23. Develop circuit boards, mock-ups, cut-aways.
24. Gather and make use of all obtainable and applicable materials from local sources and from outside industry.
25. Set up production line.
26. Organize student clubs. (Ham operators, carpentry, drafting, etc.)
27. Have active participation of "Draftsman of the Week" (applicable in any area).

DRAFTING FOR THE JUNIOR HIGH SCHOOLS

Drafting for the junior high schools must be an exploratory experience. All phases of this broad field must be viewed and their relationships to the world in which we live investigated. The study cannot be in depth but it must be thorough enough to develop industrial concepts within the student's mind and leave him with a basis for making future choices in consumer values and in occupations.

Because teaching situations in South Dakota vary so greatly, the drafting area of this guide has been written as one unit. The instructor may choose to teach it as a whole, or fit a part of it into his schedule where and when he can. It is strongly recommended that the student complete all the processes outlined here by the time he graduates from the ninth grade.

It is not expected that the junior high school student will become skilled in all these phases of drafting. It is to be hoped that he will have experienced enough to be able to apply drawing to his daily life, that he will have developed an appreciation of the true place of drafting to industry, and that he will have laid a background for future study of drafting or any of the many other fields of endeavor to which it is related or which are related to it.

OBJECTIVES OF JUNIOR HIGH DRAFTING

1. To develop in each student some knowledge of drafting and its place in industry, and some knowledge of equipment and techniques used in the drafting process.
2. To develop in each student the ability to read drawings and to visualize relationships between objects and working drawings.
3. To develop in each student the ability to express ideas graphically and solve everyday problems through the use of drawings.
4. To develop in each student the ability to recognize good design and workmanship in order to select and use industrial products wisely.
5. To present to each student an understanding of some of the occupational opportunities in this field of work.
6. To lay a background for further development of drafting, industrial arts and industrial studies.

DRAFTING

Junior High — Grades 7 - 8 - 9

The junior high drafting guide is presented here as one unit. The instructor may use it as written or he may use it in sections as he sees fit. A junior high student should have had all this material before he graduates from ninth grade.

I. Introduction to drafting
   - A. Drawings to express ideas
     1. Sketches - art
     2. Mechanical drawings
   - B. Descriptive pictures
     1. Charts, graphs
     2. Directions, details
   - C. Illustrations
     1. Books, magazines, etc.
     2. Techniques
   - D. Opportunities in drafting
   - E. Features of drafting
     1. Straight lines
     2. Curves
     3. Angles
     4. Sizes and dimensions
     5. Symbols and representations
   - F. Types of drawings
     1. Pictorial
     2. Working drawings
   - G. Planning and organizing
     1. Reading blueprints
     2. Understanding drawings
     3. Visualizing objects
     4. Orderly procedures
     5. Graphic reproductions

II. Common tools and materials
   - A. Board
   - B. "T" square
   - C. Triangles
     1. 30 - 60
     2. 45
     3. Special types
   - D. Triangular scale
   - E. Pencils, erasers, erasing shields
   - F. Compasses, bow instruments templates, dividers, etc.
   - G. Irregular curves, etc.

III. Measuring
   - A. Techniques
   - B. Inches and fractional parts
   - C. Decimals
   - D. Shop mathematics
   - E. Drawing to scale

IV. Drawing
   - A. Techniques of using drawing instruments
   - B. Straight lines, line weights
   - C. Circles, arcs
   - D. Irregular curves
   - E. Angles, intersections

V. Drawing layout
   - A. Sheet layout
     1. Border
     2. Record strip
   - B. Object drawing
     1. Placement
     2. Spacing
     3. Neatness

VI. Lettering
   - A. Kinds of lettering
     1. Gothic single stroke
        a. Vertical

b. Slant
c. Capital and lowercase
2. Proportion and spacing
3. Other types of lettering

B. Lettering devices
1. Machines
2. Templates

VII. Dimensioning
A. General rules
B. Lines, arrowheads, spacing
C. Techniques of dimensioning
D. Types of dimensions
E. Notes, etc.

VIII. Sketching
A. Value and uses of sketching
B. Materials and tools
1. Graph paper
2. Sketch paper
3. Soft pencil

C. Types of sketches
1. Pictorial
a. Perspective
b. Isometric
c. Oblique and cabinet
2. Multiview
3. Exploded drawings

D. Techniques
1. Straight lines
2. Circles, curves, arcs
3. Isometric figures

IX. Designing
A. Shop design
1. Wood
2. Art metal
3. Plastic
4. Crafts and others

X. Planning
A. Estimate size and spacing
B. Determine procedure
C. Layout

XI. Geometric constructions
A. Layout and measure lines
1. "T" square, triangles, scale
2. Compass, dividers, etc.

B. Measure and layout angles
1. Use of triangles
2. Use of compass
3. Use of protractors

C. Straight line geometric figures
D. Figures of circles, arcs and curves
1. Bow instruments and templates
2. Types of irregular curves

E. Draw geometric figures using straight lines, angles and curves

XII. Single-view drawings
A. Two-dimension figures
B. Large-sized objects
1. Layout
2. Scaling

C. Drawing techniques
1. Lettering
2. Alphabet of lines

XIII. Graphs and charts
A. Bar graphs
B. Line graphs
C. Circle graphs
D. Charts

XIV. Orthographic projection
A. Layout
1. Order of penciling
2. Visualizing

B. Principle of shade description
1. Location of views
a. Methods of placement
b. Description of placement
c. Spacing of views

C. Multiview drawings
   1. Hidden surfaces
   2. Slanting surfaces
   3. Circles, arcs and curves
   4. Dimensioning

XV. Pictorial drawings
   A. Perspective
      1. Parallel
      2. Angular
      3. Vanishing points
   B. Isometric drawings
      1. Isometric theory and techniques
      2. Non-isometric lines
      3. Isometric circles and curves
      4. Angles in isometrics
      5. Dimensioning in isometric
   C. Oblique theory and technique
      1. Oblique theory and technique
      2. Non-oblique lines
      3. Circles and curves
      4. Dimensioning oblique and cabinet

XVI. Apply techniques to shop projects

XVII. Safety

DRAFTING FOR SENIOR HIGH SCHOOL

Drafting in the senior high school must be made to serve several purposes. In common with the junior high school it must be an exploratory course. Those students who may have never had drafting surely need to be acquainted with the field and its great implications. Those who have had drafting in the junior high may wish to explore further.

Drafting can help to develop the student's capacity to understand and solve problems in any field. It helps the student to discover and develop his talents as applied to technical and applied science fields. It is essential to the student to see and understand the way in which industry functions and it can help the student to develop a measure of skill in the use of drafting equipment and his sense of accuracy, proportion and neatness.

Because planning and drawing are basic to all of industry, senior high school drafting provides a background for advanced industrial and technical work or study.

The activities of drafting classes must be related as closely as possible to all other industrial arts courses, to all school activities and to daily life to give added meaning. The student should be made to feel the immediate need for the work at hand. This should be an easily obtainable goal for drafting because of its close ties with industry, technology and everyday life.

The course outlines as presented here are designed to be used as whole units or in part or parts, at the discretion of the teacher.

OBJECTIVES OF SENIOR HIGH DRAFTING

1. To develop in each student a certain degree of skill in the uses of drafting equipment and a certain mastery of techniques involved in various aspects and phases of drafting.
2. To develop further in each student the ability to visualize real and abstract objects and ideas, and the ability to express these graphically.
3. To enable the student to see the place of visualization, planning, and drawing in industry.
4. To develop in each student a sense of good design and good workmanship in order to select and use industrial products wisely.
5. To develop in each student an understanding of drafting and related vocations so that he may be better able to choose further areas of study and/or vocations.

SENIOR HIGH DRAFTING

Semester I

I. Review of basic fundamentals
   A. Equipment
      1. Name, history, manufacture
      2. Uses, care
   B. Materials
      1. Name, history, manufacture
      2. Uses, development, future
   C. Basic procedures
      1. Drafting geometry
      2. Lettering
      3. Techniques
   D. Dimensioning
      1. Dimension lines, figures, arrowheads, extension lines
      2. Placement
      3. Techniques
         a. Circles, angles, small parts
         b. Tolerance, notes, details
      4. Decimals, fractions

II. Multiview drawings
   A. Working drawings
      1. Orthographic
         a. Techniques of projection
         b. Application, hidden lines
   B. Sections
      1. Full, half, offset, partial
      2. Revolved
         a. Spokes, ribs, broken
         b. Foreshortened portions
      3. Detail section
   C. Auxiliary view and revolutions
      1. Projection of auxiliary
         a. Sloping surfaces
         b. Curved surfaces
      2. Revolutions

III. Pictorial drawings
   A. Perspective
      1. Vanishing points
         a. Station point
         b. One point, two point
      2. Measured lines and points
      3. Circles in perspective
      4. Inclined lines
   B. Isometric
      1. Equal angles, 120 axis
      2. True lengths
      3. Non-isometric
      4. Circles, arcs, curves
   C. Diametric, trimetric
      1. Use of templates
   D. Oblique drawing, cabinet
      1. Rules for drawing oblique and cabinet
      2. Circles in oblique, cabinet
   E. Pictorial sketching
      1. Sketching techniques
      2. Perspective
      3. Renderings
      4. Production sketching

Semester II

I. Machine drafting
   A. Fasteners
      1. Bolts, screws, rivets
      2. Keys, pins, etc.
      3. Welding
   B. Simple machine parts
      1. Detail, assembly
      2. Working drawings

II. Sheet metal drafting
   A. Pattern development
   B. Triangulation

III. Electronic drafting
  A. Wiring diagrams
  B. Schematics

IV. Map drafting
  A. Plots, plats
  B. Topographic maps, weather maps

V. Architectural drafting
  A. Simple floor plans
  B. Simple elevations
  C. Details of parts
  D. Structural drafting

VI. Techniques of finished drawings

VII. Production illustrations

SENIOR HIGH ARCHITECTURAL DRAFTING

I. Organization and Orientation
  A. History and background
    1. Films, lectures, reports
  B. Basic housing
    1. Community
    2. Types
    3. Materials
    4. Construction and design
  C. New trends in housing
    1. Prefabricated
    2. Design for flexibility
    3. Styling
    4. New materials and procedures

II. Planning
  A. Area planning
    1. Living area
    2. Service area
    3. Sleeping area
    4. Basement area
  B. Lot and grounds
    1. Size and contour
    2. Plantings
    3. Natural setting
    4. Soil structure
    5. Driveways and walks
  C. Elevations
    1. Style of house
    2. Size of house
    3. Exterior design
  D. Electrical
    1. Outlets, switches, fixtures
    2. Symbols
    3. City codes
    4. Built-in appliances
  E. Plumbing
    1. Symbols
    2. Water system, sewer system
    3. Bath floor plan
    4. Kitchen plan and plumbing details
  F. Heating
    1. Hot air layout
    2. Hot water layout
    3. Electrical heat
    4. Steam
    5. Type of fuel
  G. Estimating
    1. Square foot
    2. Cost take-off
    3. Comparison of materials
    4. Labor costs
  H. Specifications
    1. F. H. A.
    2. Building codes
    3. Electric codes
    4. Plumbing codes
  I. Financing
    1. Mortgage

a. F. H. A.
b. Veterans
c. Conventional
2. Construction loan
3. Contract for deed
4. Insurance

III. Floor plans
A. Preliminary sketch
B. Footing plan, basement plan
C. First floor, second floor

IV. Details
A. Framing
1. Cornice
2. Floor
3. Wall section
4. Window
5. Stair
6. Roof
7. Door
B. Built-in
1. Cabinet, storage
2. Fireplace
3. Lighting
C. Plot
1. Contour
2. Planting

V. Elevations
A. Front, side, rear
B. Section

VI. Blue Prints

VII. Rendering

VIII. Model

ENGINEERING DRAFTING

I. Review of drafting
A. Types of drawings
1. Working drawings
2. Pictorial
B. Equipment
C. Processes

II. Techniques of drafting
A. Penciling
B. Inking
C. Reproduction
1. Processes
2. Uses
D. Lettering

III. Production drawing
A.. Shop processes
B. Production charts
C. Conventional symbols
D. Dimensions, notes, tolerance

IV. Working drawings
A. Assembly
B. Detail
C. Sectioning
D. Auxiliary views
E. Revolutions

V. Fastenings
A. Threads
B. Bolts, screws
C. Rivets, pins, keys, keyways

VI. Cams and gears
A. Kinds of gears
B. Gear representations
C. Gear terms and dimensionings
D. Principals of cam mechanisms

VII. Sheet metal drawing
A. Patterns

1. Development
B. Triangulations
C. Transitions
D. Radial line developments
E. Intersections
F. Shop problems

VIII. Pipe drawing
A. Pipe and fitting drawing symbols
B. Plumbing and steam-fitting drawing
C. Diagrammatic pipe drawing

XI. Tool design
A. Jigs and fittings
B. Special tools

X. Automotive and aircraft drawing

XI. Graphs and charts
A. Types of charts and graphs
B. Flow-charts and production charts
C. Control data charts

XII. Computer drafting

XIII. Descriptive geometry
A. Select any good text and use it as a guide to teach basic descriptive geometry. This is a pre-engineering course and may be omitted for those not college-bound. For those not college-bound, this time could be used to develop further that area of drafting most likely to assist the student in his probable future line of endeavor.

SOURCES OF INSTRUCTIONAL AIDS - DRAFTING

There are many sources of instructional aids aside from your own school, community and commercial suppliers. A number of industrial concerns distribute materials at little or no cost to schools, simply upon request. A letter on school letterhead to any of the following addresses will bring valuable information. This list is far from complete; it is meant to be only a starting point. With very little effort it can be enlarged and kept up to date.

Charts - Posters - Pamphlets

1. Olson Manufacturing Company, P. O. Box 109, Ames, Iowa 50011
2. Paache Airbrush Company, 1909 Diversity Parkway, Chicago, Illinois 60614
3. Paxton Equipment and Supply, 7401 S. Pulaski Road, Chicago, Illinois 60627
4. Eugene Dietzgen, 3874 Elm St., Denver, Colorado - or - 2425 N. Sheffield Ave., Chicago, Illinois
5. Frederick Post Company, Box 803, Chicago, Illinois 60690
6. Rutland Tool and Supply Co., Corner of 5th and Washington, Montebello, California
7. Southern Pine Association, P. O. Box 52468, New Orleans, Louisiana 70150
8. V and I Manufacturing Company, 758 Fair Oaks Avenue, Pasadena, California
9. Viewlex, Inc., Holbrook, L. I., New York

10. Home Planners Inc., 16310 Grand River Ave., Detroit, Michigan
11. University of Illinois, Small Homes Council, Building Research Council, Mimford House, Urbana, Illinois 61803
12. 3 M Company, 2501 Hudson Road, St. Paul, Minnesota 55119
13. National Warm Air Heating and Conditioning Association, 640 Engineering Bldg., Cleveland, Ohio 44114
14. L. S. Starrett Company, Athol, Massachusetts
15. Supt. of Documents, U. S. Government Printing Office, Washington, D. C.

Transparencies - Slides - Filmstrips - DRAFTING

1. Charles Beseler Company, 219 S. 18th Street, East Orange, N. J. 07018
2. Broadhead Garrett Company, 4560 E. 71st Street, Cleveland, Ohio 44105
3. Display Corporation of America, 4865 Stanton Avenue, Philadelphia, Pa., 19144
4. 3 M Company, 2501 Hudson Road, St. Paul, Minnesota 55119
5. Porta-Trace, Inc., 50 Wall St., Binghamton, New York
6. Viewlex, Inc., Holbrook, L. I., New York
7. Frederick Post Co., P. O. Box 803, Dept. 48, Chicago, Illinois 60690
8. Gaskell Teaching Aids, 13 Thistledown Drive, Columbus, Missouri
9. McGraw-Hill, Webster Division, McGraw-Hill Book Co., Manchester Rd., Manchester, Missouri 63062

Film and Film Supplies - DRAFTING

1. Aluminum Company of America, Motion Picture Section, 818 Alcoa Bldg., Pittsburg, Pennsylvania 15219
2. Association Films, Inc., 561 Hilgrove Avenue, LaGrange, Illinois 60252
3. Gaskell Teaching Aids, 13 Thistledown Drive, Columbus, Missouri
4. Frederick Post Co., Box 803, Chicago, Illinois 60090
5. Modern Talking Pictures Services, Inc., 114 Nicollet Ave., Minneapolis, Minn. 55403
6. South Dakota State University Film Service, Brookings, South Dakota
7. National Tape Recording Catalog, Dept. of Audio-Visual, Instruction of N. E. A., 1201 16th St., N. W., Washington, D. C.
8. Webster Division, McGraw-Hill Book Company, Manchester Road, Manchester, Missouri 63062
9. General Motors, Public Relations Section, Detroit, Michigan 48202
10. L. S. Starrett, Athol, Massachusetts

Books - DRAFTING

1. McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036
2. American Technical Society, Dept. W653, 848 E. 58th St., Chicago, Illinois 60637
3. Goodhart-Wilcox, Dept. 5267, 18250 Harwood, Homewood, Ill. 60430
4. Chas. A. Bennett Co., Inc., Dept. 467, 809 W. Detweiler Drive, Peoria, Ill. 61614
5. McKnight & McKnight Publishing Co., Dept. 544, Bloomington, Ill. 61701
6. Bruce Publishing Co., 710 Bruce Bldg., Milwaukee, Wisconsin 53201
7. Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632
8. Hayden Book Co., Inc., Dept. S. S. 2, 116 W. 14th St., New York, N. Y. 10011
9. Chas. Quinlan Publisher, 26 Salisbury Rd., West Barrington, Rhode Island 02890

Magazines - DRAFTING

1. Journal of Industrial Arts Education, 1201 16th St., N. W., Washington, D. C. 20036
2. American Vocational Journal, Washington, D. C. 20036
3. Industrial Arts and Vocational Education, 400 N. Broadway, Milwaukee, Wisc. 53201
4. Prakken Publishing Co., School Shop, P. O. Box 623, 416 Long Shore Drive, Ann Arbor, Michigan 48170
5. Visual Communication Instructor, 25 W. 45th St., New York, N. Y. 10036

INTRODUCTION TO
ELECTRICITY AND ELECTRONICS

The study of electricity should be included in the industrial arts instruction offered by high schools. Approximately two and one-half years of instruction should be offered the student who wishes to pursue the study. It should begin in junior high school as an exploratory experience. If the student wishes to continue in senior high schools, he has the option of one or two years, the second year being in the field of electronics.

The reason that the electrical field is considered so necessary is that the modern world is practically run by electrical power, both in the home and in industry. It is all around us. Everyone should know something about this force. Everyone should at least understand the basic principles that underlie it and make it work. Further, everyone should be able to make, at the least, simple repairs to the electrical devices that practically every household employs. This knowledge will enable a person to know the safety rules of electrical operations and why they should always be followed. If man is to live in a modern, electrical world, he must recognize the necessity of at least elementary knowledge of the force that runs the universe.

COURSE OBJECTIVES

1. To develop some familiarity with the common tools used in electrical work.
2. To provide opportunities for the student to do much exploration in simple electrical work.
3. To give the student information regarding the theory of electricity and electronics and how it functions.
4. To teach safety and safe procedures as related to the field of electricity.
5. To familiarize the student with some of the jobs an electrician does.
6. To stimulate the student to desire further experiences in the field of electricity and electronics.

ELECTRICITY - ELECTRONICS

Junior High School

I. Orientation
   A. Nature of electricity
   B. Electron theory
   C. Static electricity
   D. Common electrical terms
   E. Schematic diagramming
   F. Introduction to current electricity
   G. Basic safety information

II. Magnetism
   A. Magnetic poles and fields
   B. Laws of attraction and repulsion
   C. Magnetic substances
   D. Molecular theory
   E. Earth's magnetism
   F. Geographic and magnetic poles
   G. Induced magnetism

III. Sources of electricity
   A. Definition and uses of AC and DC
   B. Sources of electro-motive force
   C. Units of measurement
   D. Direct current flow
   E. Alternating current flow
   F. Series and parallel wiring of cells
   G. Drafting symbols and schematic diagrams

IV. Electromagnetism
   A. Principles of electromagnets
   B. Principles of solenoid
   C. Principles of transformers
   D. Principles of generators and motors

V. Flow of electricity
   A. Problems of transmission
   B. Terminal connections
   C. Soldering techniques
   D. Function of switch and other controls

VI. Low voltage circuiting
   A. Electrical symbols
   B. Diagramming techniques
   C. Kinds and conditions of electrical circuits
   D. Simple bell circuits

VII. Safety education
   A. Electrical shock
   B. Why moisture increases danger
   C. Short circuit
   D. Consumer protection
   E. Safety in the home and safety equipment

VIII. Heat
   A. Principles of the heating element
   B. Principles of fusing
   C. Thermal & magnetic circuit breakers
   D. Heating appliances
   E. Industrial applications

IX. Light
   A. Principles of lighting
   B. Parallel lighting circuits
   C. Series lighting circuits
   D. Types of controls
   E. Types of wiring
   F. Electrical power bills

G. General layout of home electrical system

X. Communications
- A. Code communication
- B. Telephone communication
- C. Radio communication
- D. Basic principles of transmitting and receiving
- E. Vacuum tubes and transistors
- F. Symbols used in electronics

XI. Basic computer technology

XII. Safety

Unit I

ELECTRICITY - ELECTRONICS

Senior High School

I. Introduction
- A. Nature of electricity
- B. Electron theory
- C. Sources of electricity
- D. Electrical terms

II. Battery
- A. Types of batteries
- B. Chemical action
- C. Safety precautions
- D. Polarity
- E. Testing procedures
- F. Care and maintenance
- G. Charging batteries

III. Safety education
- A. Electric shock
- B. Treatment of shock victim
- C. Why moisture increases danger
- D. Short circuit
- E. Consumer protection
- F. Safety in the home

IV. Soldering
- A. Composition of solder
- B. Types of solder
- C. Flux
- D. Soldering procedures
- E. Care of equipment
- F. Safety procedures

V. Electrical circuits
- A. Conditions of circuits
- B. Direct current theory
- C. Conductors
- D. Insulators
- E. Resistance
- F. Conductance
- G. Measurements
- H. Series circuits
- I. Parallel circuits
- J. Series-parallel circuits
- K. Ohm's Law
- L. Voltage drop
- M. Watt's Law
- N. Metric system and electrical measurement
- O. Circuit efficiency
  1. Rates
  2. Percentage

P. Safeguarding circuits
   1. Fuse
   2. Circuit breakers
Q. Wire size

VI. Magnetism and electro-magnetism
   A. Magnets
      1. Natural
      2. Artificial
   B. Magnetic fields
   C. Electro-static fields
   D. Magnetic poles
   E. Laws of attraction and repulsion
   F. Earth's magnetism
   G. Geographic and magnetic poles
   H. Magnetic induction
   I. Electron theory of magnetism
   J. Electro-magnetism
   K. Magnetic units
   L. Applications of magnetism

VII. Alternating current theory
   A. Difference between AC and DC
   B. The AC cycle
   C. Frequency
   D. Sine waves
   E. Peak voltages
   F. Effective voltages
   G. Phase
   H. AC generators
   I. Transformers

VIII. Inductance
   A. Magnetic fields and opposition to current change
   B. Back EMF
   C. Inductance coil
   D. Units of inductance
   E. Inductance in series
   F. Inductance in parallel
   G. Magnetic coupling
   H. Magnetic shielding
   I. Saturation
   J. Air core inductors
   K. Iron core inductors

IX. Capacitance
   A. Dielectric fields and opposition to current change
   B. Capacitors
      1. Construction
      2. Voltage ratings
      3. Types
      4. Sizes
   C. Units of capacitance
   D. Series and parallel connections
   E. Power factor

X. Inductance and capacitance in AC circuits
   A. Inductive reactance
   B. Capacitive reactance
   C. Impedance
   D. Resonance

XI. Generators
   A. DC generators
      1. Kinds
      2. Excitation
   B. Armature reaction
   C. AC generators
      1. Kinds
      2. Excitation
      3. Polyphase
   D. Efficiency
   E. Losses
   F. Maintenance

XII. Motors
   A. Principles of operation
   B. Major parts
   C. Types
      1. AC
      2. DC
   D. Sizes
   E. Uses
   F. Name plate information

G. Fusing and overload protection
H. Control circuits
I. Grounding
J. Maintenance

XIII. Automotive electricity
A. Major circuits
1. Function
2. Operation
B. Ignition system

The following to be used if Unit I is not followed by Unit II.

XIV. Introduction to radio
A. Wave motion
B. Types of waves
C. Metric system and frequency
D. Changing sound waves into electrical impulses
E. Transmitters
F. Receivers

XV. Simple receiver
A. Essential parts and function of each
B. Schematic diagrams
C. Symbols
D. Soldering procedures
E. Antenna - ground system
F. Tuner
G. Detectors
H. Reproduction of sound
I. Basic vacuum tube theory
J. Vacuum tube testing
K. Resistors
L. Transistors

XVI. Test equipment
A. Voltmeters
B. Oscilloscope
C. Tube testers
D. Signal generators

XIII. Trouble shooting procedures

Unit II

ELECTRICITY - ELECTRONICS

I. Introduction and review
A. Wave motion
B. Types of waves
1. Sound
2. Light
3. Heat
4. Radio
C. Metric system and frequency
1. Cycle
2. Kilocycle
3. Megacycle
D. How sound waves are changed into electrical impulses
E. The radio transmitter
1. Purpose
2. Block diagram
3. Modulation
a. Amplitude
b. Frequency
4. Transmitting antenna
F. Radio receiver
1. Purpose
2. Types

II. Ohm's Law
   A. Formula
   B. Applications

III. Safety education
   A. Voltages present in electronic equipment
      1. AC - DC chassis
      2. Power supplies
      3. Cathode ray tube
   B. Principles of grounding
   C. Treatment of shock victims

IV. The vacuum tube
   A. Laws of repulsion and attraction
   B. Edison effect
   C. Construction features
   D. Elements and their purpose
   E. Types of tubes and use of each
   F. Schematic diagramming
   G. Use of tube manual
   H. Significance of the tube numbers
   I. The filament, plate and grid circuit
   J. The rectifier
   K. The dectector
   L. The oscillator
   M. Amplification
      1. Voltage
      2. Power
   N. Tube testing
   O. Amplification factor
   P. Mutual conductance

V. The transistor
   A. Construction features
      1. Point-contact
      2. Function
   B. Elements
   C. Emitter base circuit
   D. Collector base circuit
   E. Amplification
   F. Transistor oscillators
   G. Symbols
   H. Analysis or check-up
   I. Comparison with vacuum tube
   J. Schematic diagramming

VI. Power supply
   A. The rectifier tube
      1. Purpose
      2. Theory of operation
      3. Current limitations
   B. The half-wave rectifier circuit
   C. The full-wave rectifier circuit
   D. The bridge rectifier
   E. The filter circuit
      1. Need
      2. Components
      3. Types
      4. Determining filter requirements
   F. The AC - DC power supply
   G. Other types of power supplies
   H. Power transformer
      1. Principles
      2. Types
      3. Tapped windings - turns ratio
      4. Efficiency, losses
   I. Vibrator power supplies
   J. Electronic power supply
   K. Dynomotor power supplies

VII. Audio amplifiers
   A. Basic vacuum tube theory
   B. The audio amplifier circuit
   C. Differences between voltage and power amplification
   D. Why impedance matching is necessary
   E. The color code and methods of marking
   F. Tolerance
   G. Wattage rating of resistors
   H. How wattage is determined
   I. Audio frequency amplification with transistors

VIII. Detector and AVC
- A. Principles of detection
- B. Simple detectors
- C. Detection in the transistor radio
- D. The filtering process of detection
- E. Multi-purpose tubes
- F. Automatic volume control
- G. Capacitors

IX. Intermediate frequency amplifiers
- A. Review voltage amplification
- B. Significance of the intermediate frequency
- C. IF amplifiers in the transistor radio

X. Local oscillator
- A. Definition
- B. Purpose in superhetrodyne circuit
- C. Tuned circuits and resonance
- D. Feed back
- E. Grid leak bias
- F. Transistor oscillators

XI. IF amplifier mixer-converter
- A. Amplification of radio frequency
- B. Mixing radio frequency
- C. Beat frequency
- D. Converting to IF frequency
- E. Pent grid tube

XII. Antenna ground system
- A. Purpose
- B. How AC powerline is used for ground
- C. Loop stick antenna

XIII. Trouble shooting and alignment of the superhetrodyne
- A. The filament circuit
- B. Rectifier circuit
- C. Filter circuit
- D. The B+ circuit
- E. The grid circuit
- F. Oscillators
- G. Tuned circuits
- H. Trouble shooting
- I. Test equipment and its use

XIV. Electrical motors
- A. Basic D'Arsonvall movement
- B. The Ammeter (DC) - Volt - meter (DC) - Wattmeter
- C. Alternating current motors
- D. Care of motors
- E. Meter symbols
- F. Safety precautions, when using motors

XV. Electronic mechanisms
- A. Switches
- B. Relays
- C. Electronic timers
- D. Photoelectric control

XVI. The oscilloscope
- A. Uses of the scope
- B. Safety factors related to its use
- C. History and development of the cathode ray tube
- D. Cathode ray tube
  1. Mechanics, deflection systems
  2. Screen composition - voltage requirements
- E. Oscilloscope
  1. Function, X and Y axis, trace, block diagram
- F. Adjusting and setting up the oscilloscope
- G. Linear time base
- H. Simple wave forms
- I. Electrical measurements
- J. Scientific and engineering uses
- K. Synchronization

XVII. Radio transmitter
- A. Types of transmitters and modulation
- B. Radio frequencies
- C. F C C regulations
- D. Oscillators
- E. Types of oscillators
- F. Methods of modulation
- G. Radio frequency amplifiers
  1. Purpose - coupling
  2. Push-pull amplifiers
- H. Use of harmonies
- I. Antenna coupling
- J. Checking output frequency

XVIII. Amateur radio
- A. The amateur station
  1. Frequency bands
  2. Equipment - power - range
- B. History and development
- C. Ham radio clubs
  1. Purpose - activities
  2. F C C regulations
  3. Emergency and disaster situations
- D. Legal requirements
- E. Basic needs of station

XIX. Citizens band radio
- A. Theory, proper use, regulations

XX. Television
- A. Transmission and reception of TV signals
- B. Major units or blocks and function of each
- C. Adjustments
- D. Cathode ray tube
- E. Color TV

XXI. Space electronics
- A. Dependent upon advancements

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Charts - Pamphlets - ELECTRONICS

1. Thoradarson Electric Mfg. Co., Chicago, Illinois
2. American Radio Relay League, West Hartford, Connecticut
3. Cowan Publishing Co., New York, N. Y.
4. Allied Radio Corp., 100 North Western Ave., Chicago, Illinois 60680
5. American Telegraph and Telephone. Contact your nearest Bell Telephone Office.
6. Better Light and Better Sight Bureau, Box 1647, Grand Central Station, New York, New York 10017
7. Cosmic Voice, Inc., Box 11, Jackson, Michigan
8. Display Corp. of America, 4865 Stanton Ave., Philadelphia, Pennsylvania 19144

9. Philco-Ford Corp., Tech. Rep. Division, Ft. Washington, Pennsylvania 19034
10. R.C.A. Electronics Trainer, Dept. P67, Bldg. 212, Camden, New Jersey 08101
11. Simpson Electrical Systems, 853 N. Dundee, Elgin, Illinois 60120
12. Electronics Aids, Inc., 6101 Falk Rd., Baltimore, Maryland 21209
13. De Vry Industries, Inc., 3956 Belmont Ave., Chicago, Illinois 60618
14. Ohmite Mfg. Co., 3652 Howard St., Skokie, Illinois
15. Ulano Products Co., Inc., 610 Dean St., Brooklyn, N. Y. 11238
16. Science Electronics 1085 Commonwealth Ave., Boston, Massachusetts 02215
17. E.I.C.O., Electronic Instrument Co., 131-01-39 Avenue, Flushing, N. Y. 11352
18. General Electric Co., 570 Lexington Ave., New York, N. Y. 10022
19. Delco-Remy Division of General Motors, Kokomo, Indiana 46901
20. General Radio Co., 275 Massachusetts Ave., Cambridge, Massachusetts 02139
21. Hampden Engineering Corp., 99 Shaker Road, E. Longmeadow, Massachusetts 01028
22. Jansen Electronics Mfg. Inc., St. Paul, Minnesota 55114
23. Sesco, Inc., 1312 South Thirteenth St., Vincennes, Indiana

Films - Filmstrips - Transparencies - ELECTRONICS

1. American Telephone and Telegraph (Consult nearest Bell Telephone Business Office)
2. Electronics Aids, Inc., 6101 Falk Road, Baltimore, Maryland 21209
3. Honeywell, Inc., P.O. Box 4776, 6000 N. Central Expressway, Dallas, Texas 75206
4. Ideal Pictures, Inc., 58 E. South Water Street, Chicago, Illinois 60601
5. 3 M Company, Dept. D. H. J. 27, St. Paul, Minnesota 55119
6. D.C.A. Educational Products, Inc., Dept. G27, 4865 Stanton Avenue, Philadelphia, Pennsylvania 11144
7. United Transparencies, Inc., P. O. Box 888, Binghamton, N. Y. 13902

Books - ELECTRONICS

1. McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036
2. American Technical Society, Dept. W651, 848 E. 58th St., Chicago, Illinois 60637
3. Goodhart-Willcox, Dept. S267, 18250 Harwood, Homewood, Illinois 60430
4. Chas. A. Bennett Co., Inc., Dept. 467, 809 W. Detweiler Drive, Peoria, Illinois 61614
5. Motor Book Dept., Desk 7362 - 250 West 55th St., New York, N. Y. 10019
6. McKnight & McKnight Publishing Co., Dept. 544, Bloomington, Illinois 61701
7. Hayden Book Company, Inc., Dept. SS2, 116 W. 14th St., New York, N. Y. 10011
8. Volt Lab Educational Systems, Buck Engineering Co., Box 686, Farmington, N.J. 07727
9. Bruce Publishing Company, 710 Bruce Bldg., Milwaukee, Wisconsin 53201
10. Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632
11. American Radio Relay

Magazines - ELECTRONICS

1. Journal of Industrial Arts Education, 1210 16th Street, N.W., Washington, D.C. 20038
2. A.V.A. Journal, 1025 15th St., N. W., Washington, D. C. 20005
3. Davis Publishing Co., Popular Electronics, New York, N. Y.
4. Hearst Publishing Co., Popular Mechanics, Chicago, Illinois
5. Popular Science Publishing Co., Popular Science, New York, N. Y.
6. Industrial Arts and Vocational Education, 400 N. Broadway, Milwaukee, Wisconsin 53201
7. School Shop, P. O. Box 623, 416 Long Shore Drive, Ann Arbor, Michigan 48170

INTRODUCTION TO GRAPHIC ARTS

The school industrial arts program including graphic arts as a part of a comprehensive shop or in a unit shop, provides a laboratory in which the student may develop proficiency in the skills of printing and duplicating processes, with history of printing, importance in the field of human endeavor and vocational opportunities as major study topics. Students learn an appreciation for good printing and develop abilities relating to selecting and purchasing of printed materials. The work includes many practical applications of English, mathematics, science and art skills. The nature of the courses is designed to be of general value to all students.

Safety education is a major facet in the teaching of every graphic arts operation and can be effective only when it is an integral part of every lesson and related to real work situations. Care must be taken that students learn precise and safe methods of workmanship - bad habits are hard to break. In advanced courses, work standards should equal those of industry.

Students should be given opportunities to design from original ideas and to modify existing work to meet their individual needs. Teachers should use the craftsman approach in which each student works on a separate project at his own pace. Any production work should be compatible with the instruction program and be included only as a sampling technique in the junior high.

OBJECTIVES OF INDUSTRIAL ARTS GRAPHIC ARTS

Every pupil, to the limit of his individual capacity, should have the opportunity:

1. To achieve competence in the use and care of the shop equipment and a degree of skill in the performance of basic graphic arts operations.
2. To gain a basic knowledge of the graphic arts processes as they relate to each other and to the total graphic arts industry.
3. To reinforce and extend academic skills in grammar, spelling, punctuation, composition, art, mathematics and science by applying them in solution of particular problems.
4. To develop the ability to recognize good design and workmanship and the ability to select, care for, and use printed materials wisely.
5. To develop proper attitudes toward himself, his work, and his daily relationship with others.
6. To gain an appreciation of the value of the printed word to civilization and particularly to our American way of life.
7. To develop the habit of orderly, efficient and complete performance of any task.

8. To develop the ability to evaluate his own accomplishments objectively.
9. To acquire an understanding of some of the occupational opportunities in the graphic arts industry.

GRADE PLACEMENT AND SEQUENCE OF INDUSTRIAL ARTS GRAPHIC ARTS

To insure the desired outcome of industrial arts graphic arts as a part of general education, courses should start in the seventh grade - at a time when 100 per cent of the youth are still in school - permitting greater depth and concentration at succeeding levels. After acquiring basic skills and vocabulary, students should be permitted to elect further specialization or other industrial arts experiences. Industrial arts should be available to both girls and boys and should not be specific preparation for wage earning.

GRAPHIC ARTS

Seventh Grade. Suggested time - 20 hours

I. Introduction to graphic arts
   A. History of printing
   B. Basic processes
   C. Project planning and layout
   D. Linoleum block printing
   E. Silk screen printing
   F. Safety

Eighth Grade. Suggested time - 30 hours

I. Application of graphic arts
   A. Importance of printing
   B. Design and layout
   C. Hand composition
   D. Platen press
   E. Paper
   F. Binding
   G. Safety

Ninth Grade. Inclusion as one of three 60-hour subject areas

or

Tenth Grade. One semester

I. Today's graphic arts industries and associated fields
   A. Occupational opportunities
   B. Practical work in:
      1. Setting type
      2. Proofing
      3. Imposition (lock-up of forms)
      4. Press operation
      5. Cutting and handling paper
      6. Bindery
   C. Introduction to process photography

D. Introduction to offset-lithography
E. Photo stencil silk screen
F. Duplicating processes
G. Safety

Eleventh and Twelfth Grades. One semester (If taken in eleventh grade, twelfth grade could be continuation of production experience.)

I. Practical problems in printing
A. Advertising and commercial art
B. Management
C. A look at the future
D. Occupational opportunities
E. Safety
F. Production experience

CONTENT OUTLINE FOR THE INCLUSION OF GRAPHIC ARTS IN INDUSTRIAL ARTS PROGRAMS

I. Introduction to graphic arts
A. History of printing
1. Words, letters, and characters
2. Beginning of copy reproduction
B. Basic processes
1. Relief
2. Stencil
3. Intaglio
4. Planography
5. Photography
C. Design and layout
D. Block carving and printing
1. Tools and equipment
2. Materials
3. Projects
E. Silk screen printing
1. Tools and equipment
2. Materials
3. Projects
F. Safety

II. Application of printing
A. Importance of printing
B. Design and layout
1. Preparation of rough copy
2. Thumbnail sketches
3. Type faces
a. Roman
b. Text
c. Italics
d. Sans serif
e. Squared serif
f. Script
4. Points and picas
5. Spacing material
C. Hand composition
1. Type cases
2. Composing stick
3. Line gauge
4. Indentations
5. Furniture and reglets
6. Quoins
7. Chases
8. Planer
D. Platen press
1. Important parts
2. Makeready
a. Tynpan paper
b. Ink
c. Gage pins

3. Press operation
4. Press clean-up

E. Paper
1. Common types
a. Newsprint
b. Fine papers
c. Cover stock
d. Bristol and tag boards
e. Weights
2. Handling
a. Jogging
b. Cutting
3. Purchasing
4. Terminology

F. Inks
1. Kinds
2. Mixing
3. Specialties

G. Binding
1. Folding
2. Collating
3. Padding or tabbing
4. Stapling

H. Safety

III. Today's graphic arts industry and allied fields

A. Occupational opportunities
1. Films
2. Field trips to local industry

B. Practical work
1. Composition
2. Proofing
3. Imposition
4. Press work
5. Auxiliary operations
a. Perforating
b. Scoring
c. Slitting
d. Numbering

C. Introduction to photography
1. Lens
2. Cameras
3. Films
4. Process work
a. Line negatives
b. Half-tone negatives

D. Introduction to offset-lithography
1. Copy preparation
2. Masking and stripping
3. Plate making
4. Presses
a. Molleton
b. Aquamatic

E. Photo stencil silk screen
1. Decalcomania

F. Duplicating processes
1. Mimeograph
a. Stencils
b. Paper
2. Spirit
a. Masters
b. Paper

G. Safety

IV. Practical problems in printing

A. Advertising (commercial art)
1. Layout
2. Design
3. Color
4. Copy preparation

B. Management
1. Estimating
2. Purchasing

C. A look at the future
1. Electronics and computers
2. Photostatic printing
3. Letterset (dry offset)
4. Web as opposed to sheet feeding

D. Occupational opportunities
1. Skilled trades
2. Management
3. Education

E. Safety

F. Production experience
   1. School production
      a. Forms
      b. Handbooks
      c. Play programs and tickets
      d. Athletic event programs

SOURCES OF INSTRUCTIONAL AIDS - GRAPHIC ARTS

There are many sources of instructional aids aside from your own school, community and commercial suppliers. A number of industrial sources distribute materials at little or no cost to schools simply upon request. A letter or post card to any of the following addresses will bring valuable information. This list is far from complete; it is meant to be only a starting place. With very little effort it can be kept up to date and enlarged.

Posters - Pamphlets - Charts - GRAPHIC ARTS

1. Challenge Machinery Co., Grand Haven, Michigan 40417
2. Martin Driscol & Co., 777 No. Merrimac Ave., Niles, Illinois 60648
3. Eastman Kodak Co., 343 State St., Rochester, N. Y. 14650
4. New York Times, 220 West 43rd St., New York, N. Y. 10036
5. NuArc Co., 4110 West Grand Ave., Chicago, Illinois 60651
6. Jack L. Popin Co., 262 Mott St., New York, N. Y. 10012
7. G. A. Pratt Co., 1108 W. Chicago Ave., East Chicago, Indiana
8. H. B. Rouse & Company, 2214 N. Wayne Ave., Chicago, Illinois

Films - Filmstrips - GRAPHIC ARTS

1. Curriculum Films, Inc., 10031 Commerce Ave., Tujana, California
2. Encyclopedia Britannica Films, Inc., Wilmette, Illinois
3. P. N. Glatfeller Co., Spring Grove, Pennsylvania
4. Grumbacher Film Library, 460 West 34th St., New York, N. Y. 10001
5. International Paper Co., 200 East 42nd St., New York, N. Y. 10017
6. National Association of Manufacturers, 2 East 47th St., New York, N. Y. 10017

Books - GRAPHIC ARTS

1. Chas. A. Bennet Co., Inc., Dept. S267, 809 Detweiler Dr., Peoria, Illinois 61614

2. Goodhart-Willcox, 18250 Harwood, Homewood, Illinois 60430
3. McKnight & McKnight Publishing Co., Dept. 544, Bloomington, Illinois
4. Morgan and Lester, New York, N. Y.
5. Delmar Publisher, Inc., Albany, N. Y.
6. Bruce Publishing Company, Milwaukee, Wisconsin
7. Taplinger Publishing Co., New York, N. Y.
8. Fairchild Davidson, 5004 Jerico Turnpike, Comack, N. Y. 11725

Magazines - GRAPHIC ARTS

1. Inland and American Printer and Lithographer
2. Reproductions Review
3. School Shop
4. Industrial Arts and Vocational Education
5. Printers Digest
6. Visual Communications Instructor

INDUSTRIAL CRAFTS

Introduction

The area of industrial crafts often falls in the realm of art, but in schools which do not carry it in the art department, it should be covered by industrial arts, with an emphasis on the industrial aspects.

The areas which will be included in this outline are leathercraft, plastics, ceramics and art metal, but other areas which may also apply are lapidary, jewelry making, glass etching, metal plating and mosaic.

It is often felt that industrial crafts is an avocational area, but the industrial applications and vocational opportunities are innumerable and this point should be stressed.

Industrial crafts lend themselves particularly well since the space required usually need not be excessive and a course can be established with tools which are usually already available and with only the addition of some special hand tools for a given area and, if it seems desirable to expand in an area, machines are available. Basic courses may be started at the junior high level or lower, but it should be understood that more elaborate courses can be established for use in the senior high.

INTRODUCTION TO INDUSTRIAL PLASTICS

The plastics industry has been described as the fastest growing in the United States. It probably has brought more new products and materials onto the market in the last five years than any other industry. Quality and quantity are the order of the day now.

Plastics should be taught in the schools in order to familiarize the students with the plastic industry, its materials and processes. The industry needs people for management, production control, designing and production. They must have a good knowledge of the field. In addition the industry needs a consuming public that is literate about plastics.

Any course which is established should meet the general objectives for industrial arts:

OBJECTIVES:

1. To provide experiences in the use of tools and materials common to a given area.
2. To provide an opportunity to express creative ability as well as to follow a specific plan.

3. To develop a systematic method of making a useful or decorative product.
4. To emphasize vocational and avocational opportunities.
5. A means of conveying theory to application.

COURSE OUTLINE FOR INDUSTRIAL CRAFTS UNIT

CERAMICS

I. Kinds of clay
   A. Earthenware
   B. Stoneware
   C. Porcelain clay
   D. Compounded clay
   E. Local clays

II. Clay preparation
   A. Adding water
   B. Kneading
   C. Wedging

III. Modeling
   A. Pinch ball
   B. Carving

IV. Coil pottery

V. Slab pottery

VI. Casting
   A. Drain molds
   B. Two piece drain molds

VII. Wheel forming

VIII. Kiln stacking and firing

IX. Glazing
   A. Brushing
   B. Dipping
   C. Pouring
   D. Spraying

X. Industrial applications
   A. White ware
   B. Structural materials
   C. Nuclear energy
   D. Electronics
   E. Space science

INSTRUCTIONAL AIDS

I. Tools
   A. Modeling tools
   B. Wire loop tools
   C. Pricker
   D. Sponges
   E. Scraper
   F. Turning tool
   G. Cutters
   H. Mallets
   I. Measuring tools
   J. Plastic tools
   K. Ceramic pencil
   L. Kiln

II. Special tools
   A. Potter's wheel
   B. Pug mill
   C. Slip casting molds
   D. Sprayer

III. Models, texts, films, etc.

ART METAL

I. History of art metal

II. Properties of metals for crafting

III. Design
- A. Function
- B. Form
- C. Preparation
- D. Simplicity

IV. Treatment of metals
- A. Annealing
- B. Pickling

V. Working procedures
- A. Angular bending
- B. Circular bends
- C. Twisting
- D. Hammering into a form
- E. Stake forming
- F. Spinning

VI. Decorating
- A. Planishing
- B. Fluting
- C. Doming
- D. Spotting
- E. Stamping

VI. Assembling procedures
- A. Soldering
- B. Riveting
- C. Cementing

VIII. Tooling foil

IX. Etching

X. Finishing procedures
- A. Chemical coloring
- B. Enameling
- C. Brushing
- D. Buffing

XI. Industrial applications
- A. Decorative items
- B. Household items
- C. Metallurgy
- D. Machine working of metal

INSTRUCTIONAL AIDS FOR ART METAL

I. Hand tools
- A. Common measuring tools
- B. Common sheet metal tools
- C. Snips
- D. Chisel and punches
- E. Hack saw
- F. Jeweler's saw
- G. Common files
- H. Jeweler's files
- I. Forms, dies and stakes
- J. Wooden hammers
- K. Silver smith, raising and ball peen hammers

II. Machine tools
- A. Hand saw
- B. Jig saw
- C. Spinning lathe
- D. Buffers, brushes and grinders
- E. Drills, portable and press

III. Models, texts, films, etc.

LEATHER CRAFT

I. History and early uses of leather

II. Processing leather
- A. Curing
- B. Tanning
- C. Types
  1. Purchasing
  2. Cost study

III. Modern processing methods

IV. Geographical sources of leather

V. Tools and equipment
   A. Square
   B. Polisher
   C. Awl
   D. Mallet
   E. Gauge punches
   F. Scissors
   G. Snips
   H. Eyelet punch
   I. Skiving knife
   J. Tracer
   K. Molder
   L. Edge creaser
   M. Stippler
   N. Cement
   O. Dye
   P. Needles
   Q. Stamping tools
   R. Templates
   S. Portable tools
   T. Storage cabinet

VI. Special activities
   A. Boy Scout projects
   B. Camping uses
   C. Hobby crafts

PLASTICS

I. Introduction and history
   A. Nature of plastic
   B. Types and kinds
   C. Growth of the industry
   D. Classification of resins and plastics

II. Demonstration, projects and design - based on the following material and processes
   A. Sheet plastics fabrication
   B. Vacuum forming and flow forming
   C. Mechanical stretch forming
   D. Cutting and machining
   E. Sanding and buffing
   F. Expandable bead foam
   G. Resin foam
   H. Surface and internal carving
   I. Dying and painting
   J. Thermofusion of pellets and powders
   K. Fiber glass lamination
   L. Vinyl plasticol casting
   M. Polyester casting and embedding
   N. Compression molding
   O. Injection molding
   P. Welding and joining

III. Usage of plastic
   A. Fabrication
   B. Home use
   C. Appliances and tools
   D. Construction and architecture
   E. Transportation and packaging
   F. Sporting goods, toys
   G. Fabrics

IV. Evaluation
   A. Tests
   B. Quizzes
   C. Projects

SOURCES OF INSTRUCTIONAL AIDS - INDUSTRIAL CRAFTS

There are many sources of instructional aids aside from your own school, community and commercial suppliers. A number of industrial concerns distribute materials at little or no cost to schools, simply upon request. A letter on school letterhead to any of the following addresses will bring valuable information. This list is far from complete; it is meant to be only a starting place. With very little effort it can be enlarged and kept up-to-date.

Pamphlets - Charts - Booklets - INDUSTRIAL CRAFTS

1. American Clay Co., 4717 W. 16th St., Indianapolis, Indiana 46222
2. Borden Chemical Co., Div. of Borden Co., 350 Madison Ave., New York, N. Y. 10017
3. Cermichrome, Inc., 15215 So. Broadway, Gardenia, California 90247
4. H. H. Perkins Co., 228 Shelton Ave., New Haven, Connecticut 06506
5. Plymouth Cordage Co., North Plymouth, Massachusetts 02363
6. Tandy Leather Co., P. O. Box 791, Ft. Worth, Texas 76101
7. Tepping Studio Supply Co., 3517 Riverside Drive, Dayton, Ohio 45405
8. Bernhart Ulmann Co., 3020 Thompson Ave., Long Island, N. Y. 11101

Films - Filmstrips - Transparencies - INDUSTRIAL CRAFTS

1. Handy and Harmon, 850 3rd Ave., New York, N. Y. 10022
2. Iowa State U., Visual Instruction Service, Ames, Iowa
3. Ohio Leather Co., 1052 No. State St., Girard, Ohio 44420
4. Society of the Plastics Industry, 250 Park Ave., New York, N. Y.
5. Loma Industries, 3000 Pafford St., Fort Worth, Texas
6. Di Arco Corporation, Lake City, Minnesota
7. Owens-Corning Fiberglass Corp., New York, N. Y.
8. Koppers Company, Plastics Division, Pittsburg, Pennsylvania

Books - INDUSTRIAL CRAFTS

1. Bakelite Corporation, New York, N. Y.
2. Coward-McCan, New York, N. Y.
3. McKnight and McKnight, Bloomington, Illinois
4. Goodhart-Willcox, 18250 Harwood, Homewood, Illinois 60430
5. Chas. A. Bennett Co., 809 W. Detweiler Dr., Peoria, Illinois 61614

6. Koppers Company, Pittsburg, Pennsylvania
7. Owens-Corning Fiberglass Corp., New York, N. Y.
8. Bruce Publishing Co., Milwaukee, Wisconsin
9. Society of Plastics Industry, New York, N. Y.
10. Reinholt Publishing Co., New York, N. Y.

INTRODUCTION TO
JUNIOR HIGH GENERAL METALS

This course provides manipulative experiences that will develop basic skills in the use of simple hand tools and materials used in metal work. Attention is directed toward the understanding of metals and their industrial uses, together with investigation of the occupations in the metal working field.

Students should acquire skill in the basic processes and use of the common tools in sheet metal, art metal, and bench metal, including layout, bending, filing, punching, drilling, and soldering. They should acquire knowledge of industrial applications of metals and processes, appreciation of safe practices in metal work, and understanding of some of the occupational opportunities and requirements for employment in the metal trade and industrial fields.

Students engage in the planning and making of metal articles, using simple tools and processes. Class discussions and questions, demonstrations, reference reading, and special studies afford experiences that assure growth in knowledge and understanding of the technical information as well as in manipulative skill.

OBJECTIVES OF JUNIOR HIGH GENERAL METALS

1. To gain experience in care and use of common metal-working tools.
2. To develop the ability to recognize good design and workmanship.
3. To develop ability in selection, care and use of products.
4. To acquire an understanding of the opportunities in metal industries.
5. To gain some knowledge of industrial processes.

JUNIOR HIGH GENERAL METALS

I. Introduction to metals
   - A. History of metals
   - B. Industrial uses
   - C. Metals in our everyday lives

II. Kinds of metals
   - A. Ferrous metals
     1. Cast iron
     2. Wrought iron
     3. Steel
     4. Ferrous alloys
   - B. Non-ferrous metals
     1. Copper and its alloys
     2. Aluminum and its alloys

3. Tin
4. Zinc
5. Magnesium
6. Other non-ferrous metals

III. Measurement
   A. Rules
      1. Fractional
      2. Decimal
      3. Uses and techniques
   B. Calipers
      1. Inside, outside, etc.
      2. Uses and techniques
   C. Micrometers
      1. Inside, outside, depth, etc.
      2. Uses and techniques
   D. Other measuring tools
      1. Squares
      2. Dividers
      3. Protractors
      4. Scribers (marking tools)
      5. Uses and techniques

IV. Bench metal-working tools
   A. Hammers
      1. Sizes
      2. Types
      3. Uses and techniques
   B. Punches
      1. Prick
      2. Center
      3. Pin
      4. Drift
      5. Uses and techniques
   C. Cutting tools
      1. Hack saws
      2. Chisels and snips
      3. Shears
      4. Uses and techniques
   D. Drilling
      1. Hand drill
      2. Drill press
      3. Portable power drill
      4. Drills
      5. Uses and techniques
   E. Files
      1. Classification
      2. Uses and techniques
   F. Abrasives
      1. Natural
      2. Man-made
   G. Holding devices
      1. Vises
      2. V-blocks
      3. Clamps
      4. Angle plates, jigs, etc.
      5. Techniques for use

V. Metal fasteners
   A. Soft solder
      1. Soldering copper
      2. Torch
      3. Electric iron
      4. Tinning
      5. Flux
      6. Uses and techniques
   B. Mechanical fasteners
      1. Rivets
      2. Screws
      3. Bolts, nuts and washers
      4. Dowels, pins and snap rings
      5. Adhesives

VI. Sheet metal
   A. Pattern development
   B. Layout
   C. Cutting
      1. Bench shears - snips
      2. Electric shears
      3. Notcher

INTRODUCTION TO
SENIOR HIGH GENERAL METAL

This is an age of metal. In almost every activity of our lives we use metal articles, which in turn were made by metal machines. Many new metals are in common use these days, and articles formerly made of wood are now being made of metal.

A modern industrial arts course in general metal will contribute to the goals of education in terms of ideals, attitudes, appreciations, and skills.

OBJECTIVES OF SENIOR HIGH METAL

1. To develop an interest in and an understanding of the place of metals industries in the social and economic life of the community.
2. To develop consumer knowledge, which involves the ability to select various products wisely, care for them properly and use them efficiently.
3. To develop safe work habits and respect for healthful working conditions.
4. To foster appreciation of good design, good material, and good workmanship in the creation of articles of beauty and usefulness.
5. To provide opportunities for developing independent planning and following the job to successful completion.

SHEET METAL - SENIOR HIGH

I. General introduction to the shop and its tools

II. Planning
- A. Project sheets
- B. Costs of materials
- C. Kinds of gauges of metal

III. Layout equipment
- A. Steel rule
- B. Squares
- C. Dividers
- D. Scribes
- E. Center punch

IV. Layout methods
- A. Pattern
- B. Direct
- C. Transfer

V. Cutting metals
- A. Hand snips
- B. Squaring shears
- C. Throatless bench shears
- D. Hack saws
- E. Chisels

F. Files

VI. Metal working tools
- A. Bar folder
- B. Pan brake
- C. Forming rolls
- D. Combination machines
- E. Hammers
- F. Jigs

VII. Drilling
- A. Feed and speed and lubricant
- B. Twist drills and parts
- C. Reaming
- D. Holding devices
- E. Sharpening drills
- F. Types of drill shanks

VIII. Fastening sheet metal
- A. Soldering
- B. Rivets
- C. Bolts
- D. Screws

IX. Finishing and polishing
- A. Raising
- B. Buffing
- C. Pickling
- D. Abrasives
- E. Annealing

X. Safety instruction

BENCH METAL

I. Power tools used in bench metal
- A. Drilling
  1. Hand drills
  2. Portable drills
  3. Drill press
  4. Drill sizes
  5. Lubricants
- B. Grinding
  1. Sizes and types of wheels
  2. Dressing a wheel
  3. Sharpening tools
  4. Sharpening drills

II. Hand tools used in bench metal
- A. Hack saw
  1. Types
  2. Sizes of blades
  3. Installing blades in frames
- B. Chisels
  1. Types
  2. Uses
- C. Bench shears
- D. Throatless shears
- E. Files
  1. Types of files
  2. Cross filing
  3. Draw filing
  4. File cards
  5. Care of files

III. Operations used in bench metal
- A. Bending and twisting
  1. Scrolls
  2. Angle bands
  3. Banding jigs
- B. Threading
  1. Types of threads
  2. Sizes of threads
  3. Taps
  4. Dies
- C. Fastening metals
  1. Screws
  2. Bolts
  3. Rivets
  4. Nuts
  5. Pins

D. Assembly tools
   1. Hammers
   2. Screw drivers
   3. Pliers
   4. Mallets
   5. Wrenches

IV. Heat treatment
   A. Annealing
   B. Hardening
   C. Tempering
   D. Case hardening

V. Safety instruction

MACHINE SHOP

I. Lathe
   A. Explain operation and parts of lathe
   B. Selection of stock
   C. Centering stock
      1. Lathe
      2. Drill press
   D. Mounting work
      1. Dogs
      2. Face plates
   E. Chucks
      1. Universal
      2. Independent
   F. Measuring
      1. Rules
         a. Conventional
         b. Decimal
      2. Micrometer
      3. Inside-outside calipers
      4. Threading dial
      5. Dial indicator
      6. Metric system
   G. Lathe speeds and feeds
   H. Straight turning
   I. Taper turning
      1. Compound rest
      2. Offset tailstock
      3. Taper attachment
   J. Thread cutting
      1. Types
      2. Speeds and feeds
      3. Cutters
   K. Sharpening cutter tools
      1. Rake
      2. Clearance

II. Shaper
   A. Operation and parts
   B. Setting up work in hold-down
   C. Speed-stroke, and feeds
   D. Types of cuts

III. Milling machine
   A. Operation and parts
   B. Controls
   C. Care of machines and cutters
   D. Cutting speeds and feeds

IV. Grinders
   A. Operation
   B. Dressing and truing wheels

V. Drill press
   A. Operation
   B. Speeds and feeds
   C. Holding metal and chucks

GAS WELDING

I. Materials and equipment
   A. Cylinders
      1. Sizes
      2. Pressures
   B. Hoses
   C. Regulators
      1. Adjustment
      2. Care of
   D. Tips
      1. Sizes
      2. Types
   E. Protective Equipment
      1. Goggles
      2. Gloves
      3. Clothing
   F. Rods
      1. Mild steel
      2. Bronze
      3. Cast
      4. Aluminum
      5. Flux

II. Techniques
   A. Adjustment
   B. Manipulation of torch
   C. Adding filler rod
   D. Penetration
   E. Reinforcement

III. Learning activities
   A. Assemble torches and hoses
   B. Operate pressure regulators
   C. Selecting correct tips
   D. Selection of materials
   E. Preparation of material
   F. Light and adjust torch
      1. Neutral flame
      2. Oxidizing flame
      3. Carburizing flame
   G. Types of welds
      1. Fusion without rod
      2. Fusion with rod
      3. Bronze weld
      4. Fillet weld (mild steel)
      5. Weld cast iron with cast and bronze rod
   H. Cutting
   I. Identification of metals

IV. Safety

A special unit should be presented on safety when teaching welding for personal and equipment protection. The possibility of fire is always present when using the gas welders. Leaks and loose connections must be taken care of immediately.

ARC WELDING

I. Equipment
   A. Welder
      1. AC
      2. DC
      3. Heat ranges
      4. Care of welders
      5. Cables
      6. Carbon arc
      7. Chipping hammers

II. Safety
   A. Personal
   B. Equipment
   C. Fire prevention

III. Rod sizes and types
   A. Mild steel
   B. Cast

IV. Techniques
   A. Striking and holding arc
   B. Penetration
   C. Preparation of metals
   D. Types of welds

V. Learning activities
   A. Striking and holding arc
   B. Straight horizontal bend
   C. Butt joint
   D. Corner weld
   E. T joint weld
   F. Lap joint weld
   G. Vertical welds
   H. Cast welding
   I. Hard surfacing
   J. Identification of metals

VI. Special equipment and techniques

FOUNDRY SUGGESTED UNITS

I. A special unit in foundry safety must be introduced before the students start working with molten metal.

II. Pattern making
   A. Composition of sand
   B. Tempering of sand
   C. Shrink rules
   D. Draft

III. Foundry sand
   A. Composition of sand
   B. Tempering of sand

IV. Crucibles
   A. Selecting correct size
   B. Handling and care of crucibles

V. Flask
   A. Cope
   B. Drag

VI. Impurities of metal
   A. Flux
   B. Slag

VII. Common tools found in foundry area
   A. Riddle
   B. Bellows
   C. Bench rammer
   D. Molder's bulb
   E. Spoon and gate cutter
   F. Slick
   G. Trowel
   H. Lifter
   I. Flask
   J. Molding board
   K. Bottom board
   L. Strike-off bar
   M. Rapping bar
   N. Riser pin
   O. Sprue pin
   P. Draw spike

VIII. Melting points of metals commonly used in school foundries

SOURCES OF INSTRUCTIONAL AIDS - METALS

There are many sources of instructional aids aside from your own school, community and commercial suppliers. A number of industrial concerns distribute materials at little or no cost to schools simply upon request. A letter on school letterhead to any of the following addresses will bring valuable information. This list is far from complete; it is meant to be

only a starting place. With very little effort it can be enlarged and kept up-to-date.

Charts - Posters - Pamphlets - METALS

1. South Bend Lathe Works, 423 East Madison St., South Bend, Indiana 46623
2. Air Reduction Sales Co., Lincoln Bldg., New York, N. Y.
3. General Electric Co., 1 River Road, Schenectady, N. Y.
4. Lincoln Electric Co., 22801 St. Clair Avenue, Cleveland 17, Ohio
5. Linde Company, Division of Union Carbide Corp., New York, N. Y.
6. L. S. Starrett Co., Athol, Massachusetts 01331
7. Behr-Manning Co., Troy, New York
8. Nicholson File Co., Providence, Rhode Island
9. National Association of Manufacturers, New York, N. Y.
10. Aluminum Company of America, 1501 Alcoa Bldg., Pittsburg, Pennsylvania
11. Kaiser Aluminum and Chemical Sales, Inc., Oakland, California
12. Carborundum Company, Niagara Falls, New York
13. Proto Tools, 2211 Sante Fe Ave., Los Angeles 45, California
14. Reynolds Metals Co., P. O. Box 2346, Richmond, Virginia
15. Brown & Sharpe Manufacturing Co., Providence, Rhode Island
16. Sheldon Machine Co., Inc., 4260 North Knox Ave., Chicago, Illinois 60641
17. Clausing, 116 N. Pitcher Street, Kalamazoo, Michigan 49001
18. Ford Service Publications, Dept. S103, P. O. Box 7750, Detroit, Michigan 48270

Films - METALS

1. Carborundum Company, Niagara Falls, New York
2. Chicago Film Distribution Center, U. S. Steel Public Relations Dept., 208 South La Salle St., Chicago, Illinois
3. Cincinnati Milling Machine Co., 4710 Marburg Ave., Cincinnati, Ohio
4. Cleveland Twist Drill Co., 1242 East 40th St., Cleveland 14, Ohio
5. Educator's Guide to Free Films, Educator's Progress Service, Randolph, Wisconsin
6. Elliott Film Company, 1112 Nicollet Ave., Minneapolis 3, Minnesota
7. General Motors Corporation, Public Relations Staff, Film Library, Detroit 2, Michigan
8. Jam Handy Organization, 2821 East Grand Blvd., Detroit 11, Michigan
9. L. S. Starrett Co., Athol, Massachusetts 01331
10. Norton Company, Worchester 6, Massachusetts
11. Rothaker, Inc., 729 Seventh Ave., New York 19, N. Y.
12. South Dakota Film Library, South Dakota State University, Brookings, South Dakota
13. Simonds Saw and Steel Co., 470 Main St., Fitchburg, Massachusetts
14. South Bend Lathe Works, 425 East Madison St., South Bend, Indiana

15. U. S. Bureau of Mines, 4800 Forbes St., Pittsburg 13, Pennsylvania
16. Air Reduction Sales Co., 2429 University Avenue, S E, Minneapolis, Minnesota
17. Aluminum Company of America, Motion Picture Section, 1501 Alcoa Bldg., Pittsburg 19, Pennsylvania
18. Lincoln Electric Company, 22801 St. Clair St., Cleveland, Ohio
19. Reynolds Metals Co., Motion Picture Dept., P.O. Box 2346, Richmond 23, Virginia
20. Behr-Manning Co., Troy, New York
21. 3 M Company, Dept. D.H.J. 27, St. Paul, Minnesota 55119

Filmstrips - Slides - Transparencies - METALS

1. McGraw-Hill, Webster Division, McGraw-Hill Book Co., Manchester Road, Manchester, Missouri 63062
2. James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio
3. Popular Science Publishing Co., Inc., Audio-Visual Division, 353 4th Avenue, New York 10, N. Y.
4. U. S. Steel Corp., 71 Broadway, New York 6, N. Y.
5. Jam Handy Organization, 2821 East Grand Blvd., Detroit, Michigan
6. United Transparencies, Inc., P.O. Box 888, Binghamton, New York, N. Y. 13902
7. American Airfilter Company, Inc., 216 Central, Louisville, Kentucky 40208

Books - METALS

1. McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. 10036
2. American Technical Society, Dept. W651, 848 E. 58th St. Chicago, Illinois 60657
3. Goodhart-Willcox, Dept. S267, 18250 Harwood, Homewood, Illinois 60430
4. Chas. Bennett Co., Inc., Dept. 467, 809 W. Detweiler Dr., Peoria, Illinois 61641
5. McKnight & McKnight Publishing Co., Dept. 544, Bloomington, Illinois 61701
6. Hayden Book Co., Inc., Dept. SS2, 116 W. 14th St., New York, N. Y. 10011
7. Bruce Publishing Co., 701 Bruce Bldg., Milwaukee, Wisconsin 53201
8. Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632
9. Chilton Company, New York, N. Y.
10. Howard W. Sams & Co., Dept. SS2, 4300 W. 62nd St., Indianapolis, Indiana 46206
11. Delmar Publishers, Inc., Albany, N. Y.
12. Davis Press, Worchester, Massachusetts
13. D. Van Nostrand, Inc., Princeton, New Jersey
14. Metal Crafts Publishing Co., Providence, Rhode Island

Magazines - METALS

1. Journal of Industrial Arts Education, 1201 16th St., N.W., Washington, D.C. 20036
2. American Vocational Journal, Washington, D. C. 20036
3. Industrial Arts and Vocational Education, 400 N. Broadway, Milwaukee, Wisconsin 33201
4. Prakken Publishing Co., School Shop, P. O. Box 623, 416 Long Shore Drive, Ann Arbor, Michigan 48170
5. Visual Communication Instructor, 25 W. 45th St., New York, N. Y. 10036

INTRODUCTION TO POWER MECHANICS

Students are given opportunity to learn the important uses made of power in industry by participating in activities and discussions and observing teacher demonstrations. These experiences also help them to acquire technical, general, and occupational information. Students are oriented in the relationship of the content of power mechanics to that of other subjects in the school curriculum.

Interest is developed through projects which appeal to youth. A variety of tools, materials, and processes are used by students to make useful articles. The correct and safe use of tools and machines is emphasized. Certain machines and operations are introduced by teacher demonstrations. Opportunities for experience in planning, designing, and drawing are provided as integral parts of the instructional program. Students share responsibility with the teacher for the organization and management of the shop.

OBJECTIVES FOR POWER MECHANICS

1. To develop appreciation for the many applications of power in the modern world.
2. To develop understanding of the basic sources of power, their types, their development, and their uses.
3. To develop skill in the repair and maintenance of power units within the ability of the pupil.
4. To become familiar with the operation of the various power units available in the shop.

POWER MECHANICS

I. Power
   - A. Historical development of power
   - B. Development of steam power
   - C. Development of the internal combustion
   - D. Measurement of work
   - E. Potential energy, kinetic energy
   - F. Measurement of power, horsepower

II. Internal combustion engines
   - A. Construction of the small gasoline engine
     1. Basic engine parts
     2. Four-stroke cycle engine
     3. Two-stroke cycle engine
   - B. Fuel systems; carburization
   - C. Ignition systems
   - D. Governors
   - E. Lubrication
   - F. Cooling systems
   - G. Routine care and maintenance
   - H. Winter storage
   - I. Trouble shooting

J. Tune-up
K. Reconditioning

III. Other internal combustion engines
A. Automobile engines
B. Diesel engines
C. Jet engines
D. Rocket engines
E. Regenerative gas turbine engines
F. Wankel type

IV. External combustion engines
A. Early steam engines
1. Newcomen
2. Watt
B. The steam turbine
1. DeLaval model
2. Curtis
3. Loelly
C. Impulse and reaction types

V. Electrical energy
A. Principles of electricity
1. Static electricity
2. Electrons in motion
3. Electrical circuits
4. Magnetism
B. Electromagnetism
1. Electrochemical sources of electrical energy
2. DC and AC electrical generators

VI. Atomic and solar energy
A. Atomic energy
1. Nature of matter
2. Atomic fission
3. Nuclear reactors
B. Solar energy
1. Solar battery
C. Tomorrow's source of power
1. Direct heat-to-electricity energy converters
2. Chemical energy to electrical energy

VII. Miscellaneous laboratory experiences with small power units
A. Engine tune-up and/or reconditioning
B. Engine repair and broken part replacement
C. Rotary lawn mower blade sharpening and balancing
D. Engine operating-period maintenance
E. Preparation of power units for off-season storage
F. Removal of power units from storage
G. Automobile power periodic inspection and maintenance
H. Preparation of automobile for cold weather operation
I. Preparation of automobile for warm weather operation
J. Measurement and calculation of horsepower
K. Measurement of two-stroke cycle engine crankcase pressures
L. Trace flow of power through motor driven gear train and calculate speed of each gear to final drive

VIII. Miscellaneous activities related to power mechanics
A. Written and oral reports relating to power sources other than petroleum fuels
B. Construction of experimental or demonstration apparatus
C. Experiments and demonstrations with commercial scientific apparatus illustrating principles of power application

D. Maintenance of newspaper and magazine clipping file relating to various phases of power

IX. Safety

SOURCES OF INSTRUCTIONAL AIDS - POWER MECHANICS

There are many sources of instructional aids aside from your own school, community and commercial suppliers. A number of industrial concerns distribute materials at little or no cost to schools simply upon request. A letter on school letterhead to any of the following addresses will bring valuable information. This list is far from complete; it is meant to be only a starting point. With very little effort it can be enlarged and kept up-to-date.

Charts - Pamphlets - POWER MECHANICS

1. Briggs & Stratton Corp., Milwaukee, Wisconsin
2. Delco-Remy Division, General Motors Corp., Anderson, Indiana
3. Clinton Engines Corp., Maquoketa, Iowa
4. Chrysler Motors Corporation, Detroit, Michigan
5. Goodyear Tire and Rubber Co., Inc., Los Angeles, California
6. Ford Motor Company, Dept. S103, P. O. Box 7750, Detroit, Michigan 48270
7. Gale Products, Division of Outboard Marine Corp., Galesburg, Illinois
8. Johnson Motors, Division of Outboard and Marine Corp., 1284 Pershing Road, Waukegan, Illinois
9. Perfect Circle Corp., Hagerstown, Indiana
10. General Motors Corporation, Detroit, Michigan
11. Ideal Picture Co., 3400 Nicollet Ave., Minneapolis, Minnesota
12. Tidewater Oil Company, New York, N. Y.
13. National Carbon Company, New York, N. Y.
14. South Bend Lather Works, South Bend, Indiana 46623
15. Snap-on Tools, 8079 B 28th Avenue, Kenosha, Wisconsin 53140
16. Sun Electric Corp., Harlem and Avondale, Chicago, Illinois 60631
17. Automotive Service Equipment, John Bean Division, Lansing, Michigan 48909

Films - Filmstrips - Transparencies - POWER MECHANICS

1. Bray Pictures Corp., New York, N. Y.
2. Dewey and Dewey, Manufacturers, Kenosha, Wisconsin
3. Motion Pictures Bureau, National Council, Y.M.C.A., San Francisco, California

4. Coronet Films, Coronet Bldg., Chicago, Illinois
5. Perfect Circle Corporation, Hagerstown, Indiana
6. Shell Oil Company, 624 S. Michigan Ave., Chicago 5, Illinois
7. General Motors Corp., Dept. Public Relations and Film Section, West Grand Blvd., Detroit, Michigan
8. McGraw-Hill Book Co., Text-Film Dept., 330 W. 42nd St., New York, N. Y.
9. Chrysler Motor Corporation, Detroit, Michigan
10. Modern Talking Pictures Service, 45 Rockefeller Plaza, New York, N. Y.
11. Almanac Films, Inc., 516 5th Avenue, New York 18, N. Y.
12. National Aeronautics and Space Administration, Washington, D. C.
13. N E T Film Service, Indiana University Audio-Visual Center, Bloomington, Indiana
14. Jam Handy Pictures Service, Inc., 7046 Hollywood Blvd., Hollywood, California
15. South Dakota Film Library, South Dakota State University, Brookings, South Dakota

WOODWORK

Introductory Explanation

Under a general heading of Semester I, Semester II and Semester III, are found (1) informational and (2) operational units that each student should experience. Many items understandably will be repeated during the Semester II and Semester III of Woodworking and no attempt has been made to write in these items each time they may occur.

It is assumed that the three semesters will be continuous; that is, enrollment in Semester II or III would have as a prerequisite the successful completion of the preceding semester.

The following is offered in the form of a guide, not a course of study, to indicate those things which should be included, not a detailed listing of how and when to do them. It is assumed that the individual teacher will be qualified to compose his own course of study to fit his particular circumstances.

Informational and operational units for power tools are presented separately, the assumption being that the use of them is dependent upon several factors such as the individual student's ability, need and readiness for their use. It is anticipated that these factors could be best assessed by the instructor as his class and individual situations demand. Generally it is felt that Semester I would provide mostly hand tool processes and Semester II and Semester III increasing amounts of power tool usage.

OBJECTIVES FOR WOODWORK

1. To provide training in the study of and practice of the care and use of wood and wood products.
2. To enable one to make a wise selection and purchase of materials.
3. To develop an understanding of the many advances in products and processes in the woodworking industry.
4. To develop the ability to appreciate good design, construction and workmanship.
5. To develop proper attitudes toward co-workers, correct procedures, leading and following, and responsibility toward tools and equipment.
6. To arouse undiscovered interest and aptitudes of students and to develop confidence and skill to a reasonable degree.
7. To provide practical experience in the area of dealing with others.
8. To develop an area of leisure time activity that will be satisfying, rewarding and wholesome.

WOODWORK, SEMESTER 1

INFORMATIONAL UNITS

The informational units will be such that would not be a necessity to the successful performance of a specific operation but would be necessary for a clear understanding and appreciation of it. Normally the informational unit should be presented prior to the operational units concerned. Following are areas students should know about:

A. Introduction - The students as well as the teacher should have an overview and know the reasons for taking a course in general woodworking.
   1. Aims and objectives
      a. Why take the course?
      b. What may be learned?
      c. What will the activities be?
      d. What will be the outcome?
      e. What are job or career opportunities?

B. Reading a drawing and planning
   1. Kinds of drawings
   2. Lines
   3. Symbols
   4. Scales
   5. Bill of material
   6. Order of procedure
      a. Importance of planning
      b. Characteristics, uses, sources and costs of materials
   7. Sources of project ideas
      a. Catalogs
      b. Magazines
      c. Furniture stores
      d. Books
   8. How to specify correct material for a job
   9. Geometric constructions used in design
   10. Essential shop math

C. Wood as a material
   1. Lumbering
      a. Forests
      b. Conservation
      c. Sawmill
      d. Seasoning
      e. Growth
   2. Kinds and Classifications
      a. Hardwoods and softwoods
      b. Common woods
      c. Characteristics
   3. Grading and dimensions
      a. Hardwood
      b. Softwood
      c. Plywood
   4. Plywood and veneers
      a. Production of
      b. Advantages and disadvantages
      c. Uses
   5. Hardboard and particle board
      a. Production of
      b. Uses
      c. Kinds
   6. Plastic laminate and others
      a. Manufacture
      b. Use

D. Hand Tools
   1. Importance of good quality tools
   2. Layout and measuring

3. Cutting
4. Scraping
5. Boring and drilling
6. Holding
7. Sharpening
   a. Types of edges
   b. Correct angles
8. Correct adjustment and use

E. Glues and Adhesives
   1. Kinds
   2. Characteristics
   3. Use

F. Mechanical fasteners
   1. Types
   2. How to select
   3. Specifications

G. Safety
   1. General mill room
   2. Specific hand tool

WOODWORKING, SEMESTER I
OPERATIONAL UNITS

A. Reading a drawing and planning
   1. Design, modify or adapt a project
   2. Make a drawing
   3. Make a bill of material
   4. Plan the procedure for a job
   5. Estimate costs
   6. Layout square cuts

B. Wood as a material
   1. Identify common woods
   2. Select correct wood

C. Hand tools
   1. Correctly use common hand tools
   2. Gauge width and thickness
   3. Adjust a plane
   4. Plane a surface
   5. Plane an edge
   6. Test with a try square
   7. Plane end grain
   8. Square stock to dimensions
   9. Saw to a line with a handsaw
   10. Layout curves with a compass
   11. Layout and make duplicate parts
   12. Use coping saw
   13. Shape edges and ends with file
   14. Layout and cut chamfers and bevels
   15. Smooth a board with abrasive paper
   16. Drill holes
   17. Countersink holes
   18. Bore holes with an auger bit
   19. Fasten with screws
   20. Make butt joints
   21. Drive and set nails
   22. Hold stock with handscrews and clamps
   23. Apply shellac, varnish and penetrating finish
   24. Care for finish brushes
   25. Apply wax
   26. Apply enamel

WOODWORKING, SEMESTER II

INFORMATIONAL UNITS

I. Following are areas that students should know about:

A. Basic principles of design
B. Kinds, sizes and uses of chisels, gouges
C. Names and uses of common woodworking joints
D. Kinds, sources and uses of glue and adhesive
E. Kinds, sizes and uses of hand planes
F. Kinds and uses of plugs
G. Methods of fastening table tops
H. Kinds, sources and uses of stains
I. How to select and use fillers
J. Kinds of finishes
K. Information concerning power tools as applicable

OPERATIONAL UNITS

II. Following are areas students should be able to perform in:

A. Transfer a design by squares
B. Saw with a backsaw
C. Trim and pare with a chisel
D. Use a gouge
E. Make common glue joints
F. Glue up work
G. Layout and test with a T-bevel
H. Adjust and use the block plane
I. Use an expansive bit
J. Make counterbored and plugged joints
K. Divide spaces with dividers
L. Use a hand scraper
M. Sharpen a hand scraper
N. Fasten on table tops
O. Dress a screwdriver
P. Apply stain
Q. Apply paste filler
R. Use wood putty, stick shellac, putty stick, etc.
S. Apply penetrating and surface finishes
T. Operations suggested concerning power tools as applicable

WOODWORKING, SEMESTER III

INFORMATIONAL UNITS

I. Following are areas that students should know about:

A. Kinds, types and use of cabinet hardware
   1. Hinges
   2. Pulls
   3. Catches
   4. Casters and glides
   5. Locks

B. Kinds of edge treatment

C. Care, adjustment and use of spray equipment

D. Information concerning power tools as applicable

OPERATIONAL UNITS

II. Following are areas that students should be able to perform in:

A. Layout and install cabinet hardware

B. Apply inlay and veneers

C. Apply finish with spray equipment

D. Operations suggested concerning power tools as applicable

POWER TOOLS AND MILLROOM MACHINES

The power tools listed may be introduced to the student during any of the three semesters.

This should be determined by the instructor, depending on the age and maturity of the student being taught.

Generally it would be conceded that the junior high school student would be capable of using the electric hand drill and portable sanders, jig saw, drill press, lathes, stationary sanders and possibly the band saw.

At a later time, probably during the second and third semesters, the rest of the power tools can be introduced and used.

INFORMATION - PORTABLE TOOLS

I. Hand drill
   A. Safe operation of machine
   B. Range of work to be done with machine
   C. Types and sizes of bits

II. Sanders
   A. Safe operation of machine
   B. Range of work to be done with machine
   C. Types, grits and proper use of sandpaper

III. Router
   A. Safe operation of router
   B. Range of work to be done with machine
   C. Types of router bits
   D. Use of shaper attachment

IV. Saber saw
   A. Safe operation of machine
   B. Range of work to be done with machine
   C. Types and sizes of blades to be used

V. Cut off saw
   A. Safe operation of machine
   B. Range of work to be done with machine
   C. Types and sizes of blades to be used

OPERATIONS

I. Hand drill
   A. Adjust chuck
   B. Drill holes
   C. Use depth attachment

II. Sanders (kelt, vibrator and oscillating)
   A. Sand flat work
   B. Sand curved surfaces
   C. Sand end grain

III. Router
   A. Shape straight edges
   B. Shape inside and outside curves
   C. Cut joints and make stopped cuts

IV. Saber saw
   A. Saw curves
   B. Rip stock
   C. Cut off stock

V. Cut off saw
   A. Adjust the machine
   B. Cut off stock
   C. Rip stock

INFORMATION TOPICS

I. Jig saw
   A. Characteristics of well designed and well constructed woodworking machinery
   B. Rules for safe operation
   C. Set up and adjust machine
   D. Range of work which may be done on the jig saw
   E. Types and sizes of jig saw blades

II. Band saw
   A. Rules for safe operation of the band saw
   B. Range of work to be done on the band saw
   C. How to care for and adjust the band saw
   D. Types and sizes of band saws

III. Jointer
   A. Safety rules for operation of the jointer
   B. Types and sizes of jointers, their manufacture and cost
   C. Range of work that may be done on the jointer
   D. How to remove, gring, joint, whet and replace jointer knives
   E. How to care for and operate the jointer

OPERATIONS

I. Jig saw
   A. Adjust the machine
   B. Saw curves
   C. Resaw stock
   D. Rip stock
   E. Cut off stock

II. Band saw
   A. Adjust the machine
   B. Saw curves
   C. Resaw stock
   D. Rip and cut off stock
   E. Cut tenons

III. Jointer
   A. Adjust the machine
   B. Joint an edge
   C. Cut a chanifer or bevel
   D. Make a spring joint
   E. Surface narrow stock
   F. Remove wind from stock
   G. Cut a rabbit
   H. Cut tapers

INFORMATION - MILLROOM MACHINES

IV. Circular saw
- A. Rules for safe operation of the circular saw
- B. Types, uses, and sizes for the circular saw
- C. Range of work which may be done on the circular saw
- D. How to care for and adjust the saw
- E. How to change saws, dado heads and other accessories
- F. How to joint, set and sharpen circular saws

V. Drill press
- A. Safety rules for operating the drill press
- B. Range of work to be done on drill press
- C. How to care for and adjust the saw
- D. How to use and change bits and other accessories

VI. Lathe
- A. Safety rules for operating the turning lathe
- B. How to adjust and care for the lathe
- C. Types and sizes of lathes
- D. Range of work to be done on the lathe

VII. Shaper
- A. Safety rules for operating the shaper
- B. Range of work which may be done on the shaper
- C. How to change knives and heads and adjust the shaper
- D. Types, sizes and uses of shapers

OPERATIONS

IV. Circular saw
- A. Set up and adjust the machine
- B. Rip and cut off stock
- C. Cut various joints
- D. Resaw stock
- E. Make cove cuts

V. Drill press
- A. Adjust chuck
- B. Drill holes
- C. Sand
- D. Mortise

VI. Lathe
- A. Center stock
- B. Mount work between centers
- C. Rough down with gouge
- D. Smooth with skew
- E. Lay off pattern on stock
- F. Mark off with skew
- G. Use porting tool
- H. Cut shoulders and tapers with skew
- I. Cut convex surface with skew
- J. Scrape with skew
- K. Scrape with diamond point
- L. Measure with inside and outside calipers
- M. Cut concave curves with gouge
- N. Make and use templates

O. Mount work on a face plate
P. Mount work on a screw chuck
Q. Size work on a face plate
R. Hollow out work on a face plate
S. Cut off stock in the lathe
T. Sandpaper stock in the lathe
U. Apply finish on the lathe

VII. Shaper
- A. Flute turned stock
- B. Shape straight edges
- C. Shape inside and outside curves
- D. Duplicate small pieces using a pattern or jig
- E. Make stopped cuts, using jigs

INFORMATION

VIII. Mortise
- A. Safety rules for operating the mortise
- B. Range of work which may be done on the mortise
- C. Types, sizes and uses of the mortise

IX. Surfacer
- A. Safety rules for operating the surfacer
- B. Range of work which may be done on the surfacer
- C. How to care for and adjust the surfacer
- D. Types, sizes and uses of the surfacer

X. Radial arm saw
- A. Safety rules for operating radial arm saw
- B. Types, uses and sizes of radial arm saw
- C. Range of work which may be done on the radial arm saw
- D. How to care for and adjust the radial arm saw

XI. Grinder
- A. Safety rules for operating the grinder
- B. Types, sizes and uses of grinding stones
- C. Range of work to be done with the grinder
- D. How to care for and adjust the grinder

OPERATIONS

VIII. Mortise
- A. Set up and adjust the machine
- B. Make through mortises
- C. Make blind mortises
- D. Cut compound mortises

IX. Surfacer
- A. Adjust the machine
- B. Surface stock to thickness
- C. Cut narrow pieces to width
- D. Surface thin stock using backing board

X. Radial arm saw
   A. Set up and adjust the machine
   B. Rip and cut off stock
   C. Cut grooves and dadoes
   D. Cut joints

XI. Grinder
   A. Set up and adjust the grinder
   B. Sharpen blades and bits

INFORMATION

XII. Belt and disc sander
   A. Safety rules for operating the sander
   B. Range of work which may be done on the sander
   C. Types, sizes and uses of sander

OPERATIONS

XII. Belt and disc sander
   A. Sand flat work
   B. Sand curved surfaces
   C. Sand and grain

SOURCES OF INSTRUCTIONAL AIDS - WOOD

There are many sources of instructional aids aside from your own school, community and commercial suppliers. A number of industrial concerns distribute materials at little or no cost to schools, simply upon request. A letter on school letterhead to any of the following addresses will bring valuable information. This list is far from complete; it is meant to be only a starting point. With very little effort it can be enlarged and kept up-to-date.

Charts - Posters - Pamphlets - WOOD

1. Brown & Sharp Manufacturing Co., Providence, Rhode Island
2. Southern Pine Association, P. O. Box 52468, New Orleans, Louisiana 70150
3. 3 M Company, 2501 Hudson Road, St. Paul, Minnesota 55119
4. Small Homes Council, Building Research, Mumford House, Urbana, Illinois 61803
5. The Stanley Works, New Britain, Connecticut 06050
6. Merit Abrasive Products, Inc., 5515 West 104th St., Los Angelos, California 90004
7. Better Light Better Sight Bureau, Dept. 1-2, P.O. Box 1647, Grand Central Station, New York, N. Y. 10017
8. National Safety Council, 425 North Michigan Avenue, Chicago, Illinois

9. Ford Service Publications, Dept. S103, P.O. Box 7750, Detroit, Michigan 48270
10. Behr-Manning Company, Troy, New York
11. Simonds Saw & Steel Co., 470 Main St., Fitchburg, Massachusetts 01420
12. National Forest Products Association, 1619 Masachusetts Avenue, N.W., Washington, D. C. 20036
13. National Oak Flooring Association, 814 Sterick Bldg., Memphis, Tennessee 38103
14. National Paint Varnish & Lacquer Assocation, 1500 Rhode Island Avenue, N.W., Washington, D. C. 20005
15. Nicholson File Co., Providence, Rhode Island 02904
16. Rockwell Mfg. Co., Power Tools Division, Rockwell Bldg., Pittsburg, Pa. 15208
17. Southern Hardwood Lumber Mfg. Assoc., 805 Sterick Bldg., Memphis, Tennessee 38103
18. Timber Engineering Co., 1619 Massachusetts Ave., N.W., Washington, D.C. 20036
19. U.S. Dept. of Agriculture, Publications Division, Office of Information, U. S. Printing Office, Washington, D. C. 20402
20. United States Plywood Corp., 2305 Superior Avenue, Kalamazoo, Michigan 49003
21. Western Red Cedar Lumber Assn, 4403 White-Henry-Stewart Bldg., Seattle, Washington
22. Frank Paxton Lumber Co., 6311 St. John St., Kansas City, Missouri 64123
23. Western Wood Products Association, 700 Yeon Bldg., Portland, Oregon 97204
24. Sellstrom Mfg. Co., Highway 53 at U. S. 14, Palatine, Illinois 60067
25. Weyerhauser Co., Box A-76, Tacoma Bldg., Tacoma, Washington 98401
26. American Plywood Association, 1119 A Street, Tacoma, Washington
27. American Walnut Mfg. Assn, 666 Lakeshore Drive, Chicago, Illinois 60611
28. California Redwood Assn, 617 Montgomery St., San Francisco, California 94111
29. Hardwood Plywood Assn., P. O. Box 6246, Arlington, Virginia 22206
30. Longview Fiber Co., Longview, Washington
31. Industrial Forestry Assn, 1410 S. W. Morrison St., Portland, Oregon
32. Pacific Coast Association of Pulp & Paper Manufacturers, 930 American Bank Bldg., Portland, Oregon

Films - Filmstrips - Transparencies - WOOD

1. General Motors Corp., Public Relations Staff, Film Library, Detroit, Michigan
2. South Dakota Film Library, S. D. State University, Brookings, South Dakota
3. Behr-Manning Co., Troy, New York
4. 3 M Company, Dept. D.H.J. 27, St. Paul, Minnesota 55119
5. Elliott Film Service, 1112 Nicollet Ave., Minneapolis, Minnesota
6. Jam Handy Organization, 2821 East Grand Blvd., Detroit 11, Michigan
7. United Transparencies, Inc., P. O. Box 888, Binghamton, New York, N. Y. 13902
8. Ideal Pictures, Inc., 58 E. South Water St., Chicago, Illinois 60601
9. Viewlex, Inc., Holbrook, Long Island, New York, N. Y.
10. American Forest Products Industries, Inc., 1816 N. Street N.W., Washington, D. C. 20036

11. American Plywood Association, 666 Lakeshore Drive, Chicago, Illinois 60611
12. Bemis Brothers Bag Co., 604 S. 4th St., Minneapolis, Minnesota
13. California Redwood Assn, 617 Montgomery St., San Francisco, California 94111
14. Hardwood Plywood Manufacturers Assn, P.O. Box 6246, Arlington, Virginia 22206
15. Simonds Abrasive Co., Div. of Simonds Saw, Tacony & Fraley Station, Philadelphia, Pennsylvania
16. Rockwell Mfg. Co., Power Tool Division, Rockwell Bldg., Pittsburgh, Pennsylvania
17. Southern Pine Assn, National Bank of Commerce, P. O. Box 52468, New Orleans, Louisiana 70150
18. Stanley Tools, Div. of Stanley Works, 600 Myrtle St., New Britain, Conn. 06050
19. U.S. Dept. of Agriculture, Motion Picture Service, Office of Information, Washington, D. C. 20025
20. United States Forest Service, Washington, D. C.
21. West Coast Lumberman's Assn, 1410 S. Morrison St., Portland, Oregon 97203
22. Weyerhauser Co., Box A74, Tacoma Bldg., Tacoma, Washington 98401

Books - WOOD

1. McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 10036
2. American Technical Society, Dept. W653, 848 E. 58th St., Chicago, Illinois 60637
3. Goodhart-Wilcox, Dept. 5267, 18250 Harwood, Homewood, Illinois, 60430
4. Chas. A. Bennett Co., Inc., Dept. 467, 809 W. Detweiler Drive, Peoria, Ill. 61614
5. McKnight & McKnight Publishing Co., Dept. 544, Bloomington, Illinois 61701
6. Bruce Publishing Co., 710 Bruce Bldg., Milwaukee, Wisconsin 53201
7. Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632
8. Hayden Book Co., Inc., Dept. SS2, 116 W. 14th St., New York, N. Y. 10011
9. Chas. Quinlan Publisher, 26 Salisbury Rd., West Barrington, Rhode Island 02890

Magazines - WOOD

1. Journal of Industrial Arts, 1201 16th St., N. W., Washington, D. C. 20036
2. American Vocational Journal, Washington, D. C. 20036
3. Industrial Arts & Vocational Education, 400 N. Broadway, Milwaukee, Wis. 53201
4. Prakken Publishing Co., School Shop, P. O. Box 623, 416 Long Shore Drive, Ann Arbor, Michigan 48170
5. Visual Communication, 25 W. 45th St., New York, N. Y. 10036

RECOMMENDED STANDARDS

Every instructor who teaches any course in the industrial arts field must be a graduate of an approved four-year college or university and must have at least a minor in the field.

Industrial arts should be available for all seventh and eighth grade students and required. In the smaller schools where enrollment in seventh, eighth and ninth grades is not large enough to conduct classes for each separate grade, these three grades may be combined into one. This same arrangement may be made in grades ten, eleven, and twelve, also. Where this is put into effect, it is recommended that all students study in the same area at the same time even though on different levels.

Not less than an aggregate of two semesters of industrial arts should be available during the seventh, eighth and ninth grades. Periods should not be less than fifty-five minutes.

Industrial arts should be an elective in grades ten, eleven and twelve. The industrial arts laboratory must have at least one hundred square feet of floor space for each student.

Equipment must be the same quality as found in industry.